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Editorial Notes.

Direct Recovery of Ammonia on Gas-Works.

THE ammonia problem has become acute, complex, and vexatious. Synthetic ammonia has caused prices to tumble; and the only way to get better returns for bye-product ammonia appears to be by doing everything possible to reduce the costs of production. Supplementing those difficulties comes the greater official insistence that the effluents from ammonia plants shall be made innocuous by the adoption of one of two methods—treatment to destroy their oxygen absorbing power, or the adoption of some method of extracting the phenols. In a paper which Mr. L. H. Sensicle, B.Sc., F.I.C., of the Newcastle and Gateshead Gas Company, read before the North of England Gas Managers' Association last Friday, he presented for consideration an excellently constructed case for the application of a direct method of recovery, by which at any rate some relief can be secured from our present ammonia afflictions. There is no room for cavil that, if a process is capable of solving the effluent problem without adding to the present cost of sulphate recovery—indeed, giving a saving equal to 5 p.ct. of the selling price—then it is worth serious investigation. Mr. Sensicle's examination of the problem is timely in view of the work that is being done by The Institution of Gas Engineers in conjunction with the Leeds University.

In approaching consideration of this question to-day, we must not allow our minds to be swayed by past ill-successes with the incorporation of the direct process of recovery in gas-works practice. The trials were mostly on a small scale, and the yield of sulphate of ammonia per ton of coal was low—something in the region of 17½ lbs. But the trials were made on incorrect lines. The saturators were placed in wrong positions; purifiers were disorganized; and technical supervision was not what it should have been. Actually the principles involved, as Mr. Sensicle's paper fully demonstrates, are theoretically simple. It is clear the question must be approached *de novo*, in the light of the experience and new knowledge that has been gained in the coke-oven industry and from private investigation. In the paper, reference is made to the direct and the semi-direct processes. In both successful working is primarily dependent upon the study and control of the temperature and humidity conditions of the gas. The direct recovery process must be worked on gas at a higher temperature than its dewpoint; the semi-direct process can be introduced at a later stage in the cooling of the gas. By placing the saturator at a point where the gas is at a temperature several degrees above its dewpoint, the saturator can be operated without an accumulation of mother liquor; but, if installed at any other point, then precautions are necessary to avoid undue condensation.

The Otto and the Simon-Carves direct systems are examined in detail in the paper. There is no doubt that Mr. Sensicle favours the direct process for gas-works as being the more economical—in fact, the conditions at gas-works ought to be more suitable to its adoption than those obtaining at coking plants where the washed coal may contain something like 15 p.ct. of moisture by weight of the coal charged. In such conditions, the saturator would have to be worked at a temperature in the neighbourhood of 80° C. (176° Fahr.), in order to be on the safe side of the dewpoint. In gas-works, with the use of dry coal, the gas from the retorts would carry water perhaps amounting to 5 p.ct. of the weight of the coal. The dewpoint, in such circumstances, would be 55° C. (131° Fahr.); so that a working temperature of 60° C. (140° Fahr.) should be high enough for the operation of the direct recovery saturator in gas-works practice. Of course, in vertical retort working, there is a certain amount of undecomposed steam in the gas due to the steaming process. With horizontal retorts, where the gas is bubbled from a dip-pipe in a seal of liquor, this has the effect of cooling the gas, and imparting additional moisture to it. However, the temperature conditions shown in some spot temperature records in the paper indicate that the temperature conditions in a vertical retort installation are satisfactory for the employment of direct recovery, for without any special precautions—such as the lagging of mains—the temperature of the gas at the first cooling plant is over 160° Fahr.—that is, 20° above that suggested for the working of the saturator when dry coal is carbonized. In the case of horizontal retorts, the double disadvantage of wetting and cooling the gas unduly by passing through a seal of liquor can be readily overcome by adopting one of the anti-dip devices, by means of which the equivalent of a dry main is obtained. Having realized conditions in which the gas leaving the retort-house is at a sufficiently high temperature, and has not been subjected to an appreciable increase in humidity, it is necessary to ensure that the gas is conveyed to the saturator, through the tar extraction apparatus and exhausters, without falling below 160° Fahr. This may be secured by short distances of travel, and sometimes lagging of the pipes may be advisable. Regarding the suggestion that the adoption of direct recovery on gas-works would prove troublesome on account of the variation of gas make from time to time, Mr. Sensicle suggests that this could be overcome by installing, for the reduced outputs, a smaller auxiliary saturator, and changing over to it when the makes are seriously curtailed.

The case for direct recovery is carried by the author to its advantages over the present method. The main one is the savings which are to be effected in the first cost and running expenses of the plant. Ammonia scrubbers, circulating pumps, liquor stills, and liming plant are eliminated, and the labour required should not be greater

than with indirect plant. The large steam requirements of the ammonia stills are extinguished; and this implies a setting free of boiler plant, fuel, and labour for other purposes. From Mr. Sensicle's investigation, it seems safe to say that a saving of at least 10s. per ton of sulphate made should be shown in favour of the direct recovery method, representing 5 p.ct. of the selling price of sulphate at the present time. Such a saving is worth serious consideration.

As to the effluents problem, the author shows that the direct system has potentialities for its successful solution. By the process the amount of effluent would be only one-fifth the present quantity. The noxious constituents are practically confined to phenolic bodies, which exist in sufficient concentration to render probable their successful extraction by solvents such as benzole. In fact, it appears likely that extraction could be made a profitable proposition in view of the market value of the phenols.

As previously mentioned, Mr. Sensicle skilfully constructed a good case for direct ammonia recovery. There are many points in it which are not touched upon here—particularly interesting being those under the cross heading "Some Experiences with Direct Recovery." There 24 to 25 lbs. of sulphate per ton of coal is given as an average figure with the Simon-Carves plant, and that is well over the production obtained with similar coals carbonized at gas-works.

A Presidential Address from Tredegar.

There was a candour which we much admire about the Presidential Address of Mr. D. Walter Davies, of Tredegar, to the Wales and Monmouthshire Institution of Gas Engineers. He had acknowledgments to make, and nothing to hide. He reminded us of our indebtedness to the men of the past. We are afraid that the glamour of our successes in these days in the gas industry often causes its men to forget those who have gone before, and how much they did which made possible what we are doing to-day. There is truth in our talk of the greater responsibilities of these times, of the fierceness of the competition which we have to meet, and of the developments which have taken place around us, and which, on the one hand, give us new opportunities, and, on the other, assail our interests with a keenness which demands in the contest our very best energies and the application of our utmost knowledge. The circumstances of these times for the industry are not the same as in the past. Then our precursors in gas engineering and management and in the utilization of gas were cutting out new roads and making progress, but with the handicap of a limited knowledge compared with what we now possess through the advances of scientific research and discovery, which have made of our plant, appliances, processes, and their effects, whether of production or utilization, something of which those who have gone before never even dreamed. We must not forget our forerunners. They prepared the way for us, as we are doing for our successors. The President acknowledged how much he owed to the advice of the late Mr. Thomas Canning. It is a glorious thing to have accomplished something in serving our successors. We have no patience with those who ask, in excuse for neglect of opportunities: "What has posterity done for "us?" They would be more rational if they asked themselves, what their predecessors did for them. If our interest in the education and training of the young men to whom sooner or later the reins must be handed is of an order which will impress itself upon their memory, then we are doing something which will keep green the recollection of our service—a service beneficial to the future of the industry, as well as to our own times. In illustration Mr. Davies referred to the infinite pains that are taken at the Cardiff Gas-Works—the chief of which is Mr. H. D. Madden, the President of the Institution of Gas Engineers—to afford all possible facilities for students to obtain practical knowledge. Mr. Madden's interest in technical education and in doing all he can to advance the training of the juniors of our industry, is too well known to call even for mention. It is pride in the industry and jealousy of its reputation that inspire in this direction. All that is done in that way to assist in improving the knowledge of our young men is constructive work, and those who benefit from it will always associate with their advancement in the technique of their profession those who made available the opportunities. Mr. Davies freely acknowledged his indebtedness to men of the past.

We have said that the President had nothing to hide. If he had, he did not attempt it. He made confession that, through various causes, his gas-works (he is also Engineer and Manager of the water-works) are not the most modern in type and method. As a matter of fact, the output of gas last year was only 70 million c.ft., and, as he says, the carbonizing plant is very inadequate. It consists of stop-ended horizontal retorts, charged and discharged by hand, with all the attendant labour and other difficulties; and their capacity is perilously near being insufficient for a maximum day's demand. But for some time past, the Gas Committee have been actively investigating different modern systems of carbonization; and, as a result, they have resolved upon an installation of continuous verticals. The President seemed rather to anticipate that some of his friends would smile at the idea of such retorts being used for South Wales through coal; but we cannot see that there is anything at which to smile, nor does the President himself, inasmuch as among the installations inspected, he and his Committee have come across similar retorts which have been operating satisfactorily on the same coal for the past seven years. That is evidence that they will be safe in adopting them; and, indeed, there is no reason why, with continuous vertical retorts which lend themselves to temperature and rate-of-throughput adjustments, any class of coal should not be carbonized. Moreover, the engineer who can get 14,281 c.ft. per ton of coal from horizontals such as Mr. Davies has at Tredegar, may be relied upon to get the maximum advantage from continuous vertical retorts. By the way, it would have been interesting to have had from him the calorific value of the gas from the horizontals, as, judging by cubic feet alone, the production is a highly creditable performance.

But the condition of the President's carbonizing plant and the scrupulous care he has to exercise in controlling make to meet the maximum day's requirements (without the aid of a water-gas plant) are not the only troubles which he and gas engineers in other mining areas have to encounter. Their duties and experiences include conditions that are in excess of those of gas engineers operating in circumstances which are normal in respect of subterranean influences. At Tredegar, the President has to supply gas through a distribution system which is ever exposed to the unfriendly attentions of subsidences through mining; and he congratulates himself when the unaccounted-for gas is only of the order of two or three times more than is found in the district of a gas undertaking favoured by stable sub-soil conditions. In the address, figures are given which run back to 1885, and which show the serious losses that arise from broken mains and services and drawn joints. Last year, he was fairly lucky in having a loss of only 15 p.ct.; but all the figures away back to 1912 are high, and in that year 31·24 p.ct. leakage was registered. The vagaries in respect of unaccounted-for gas with which gas undertakings in such localities have to contend are illustrated by these figures: In 1885, the leakage was 13·76 p.ct.; in 1889, 6·5 p.ct.; in 1897, 25·4 p.ct.; in 1904, 3·9 p.ct.; and in 1907, 29·5 p.ct. Such losses as those shown by the higher figures are bad enough for an undertaking and the engineer who is responsible for its well-being. But when added to them the engineer is called upon to defend himself against charges of negligence through some unkind happening from the subterranean and (until they occur) invisible disturbances, he has enough to keep his nerves on edge.

However, there were many other points of interest in the address, some of which indicate that Mr. Davies has a Council who believe in progressive work, and what is of equal importance a Council who have the fullest confidence in their Engineer and Manager. To this the Chairman of the Council (Mr. W. R. Hopkins, J.P.) and other members handsomely testified during the proceedings at Tredegar last Thursday. Such relations as are found there are those which, we know from long experience, lead to the best issues for the ratepayers generally.

The Kerosene Tax.

PARLIAMENT and the Chancellor of the Exchequer last week gave evidence of their sincere consideration for the cottagers of our country and the dwellers in rural areas into which gas or electricity supply has not yet penetrated. Immediately after the Budget speech, critics in all parts of the House searched for points upon which they could attack the scheme for the alleviation of rate-oppressed productive industry, and the methods by which Mr. Churchill had planned to raise the necessary finance for dispensing that relief. The chief objection which could be found, not only by the Labour Party, but by Conservatives and Liberals alike, was the proposal to include kerosene among the imported white oils which are to be subject to the tax of 4d. per gallon. It was generally considered that this impost would inflict an unnecessary burden on the poorer section of the community; but analysis shows that the effect would not have been so alarming as the critics attempted to make out. There are, of course, good reasons which could be advanced in favour of imposing a tax upon kerosene in company with other of the light oils. On the other hand, the users of oil for lighting being the poorer class is an excellent cause for not saddling them, through taxation, with a higher price for paraffin. As is well known, paraffin is not only used for lighting by many of the poorer householders of the country, but a large number employ it also for heating and cooking, especially in the rural areas. No doubt Mr. Churchill, in proposing the inclusion of kerosene among the taxable light oils, had in view (in fact, he confessed as much) that the tax would help the coal industry, seeing that, during the coal stoppages, people largely bought oil-stoves for heating and cooking, and so became accustomed to their use. The shale oil industry also came within the range of consideration.

It is computed that the kerosene tax would have brought into the Exchequer about £2,900,000; but it must not be assumed that the whole of this sum would have been drawn from cottagers or rural domestic consumers. About one-third of the imported paraffin oil is consumed industrially; and of the remaining two-thirds only about one-half is burned in cottage homes. Well-to-do people have adopted portable oil heating stoves for, in the severe part of the winter, placing in their halls and large rooms. Probably the tax would have represented, on the domestic consumption of kerosene, something like £1,250,000 to £1,500,000 per annum. The sum would, of course, have been enormously greater had it not been that the gas industry has connected to its mains close upon 4·75 million prepayment gas consumers. We cannot agree with Mr. Snowden, who was Chancellor of the Exchequer during the Socialist-Labour Government, that the kerosene tax would have meant a difference of about £4 a year to the expenditure of the average family. Such a sum would represent a consumption of no less than 240 gallons a year, or 4·6 gallons a week; and we imagine that very few cottagers use that quantity as an average through the year. However, the Chancellor, on Tuesday of last week, bowed to the views of friends and political opponents, and took the wind out of the sails of the critics by voluntarily moving an amendment withdrawing the tax on this particular class of oil. Some of the newspapers, with eyes fixed more on popularity than on accuracy, endeavoured to promulgate the view that the week's purchases of kerosene by the cottagers of the country would give them a nice refund from the tradesmen with whom they do business. It is ridiculous to suppose that the tax on the purchases of oil by a cottager in one week would represent a sum which would cause him any great elation. There is no doubt, however, that the residents on some housing estates, where the local authorities have imposed the condition that electric cookers and other heaters shall be used, in order to increase business for the electricity undertaking, will feel happy in the knowledge that the oil cooking stoves and heaters which they have purchased in their discontent with electrical appliances will not now, through the withdrawal of the tax, cause them any greater expense than heretofore. Also those people who maintain paraffin lamps as a stand-by against electrical collapses will be pleased that their prudence will not be the means of causing them to subscribe anything additional to the National Exchequer—beyond what, if owners of motor-cars, they have to pay as tax upon imported petrol.

"B.I.F." Gas Section in 1929.

THE Gas Section of the British Industries Fair at Birmingham next year is to be a national affair. The success of the Section in February this year justifies the taking of a larger view. The experience then was that the number of gas engineers and buyers who visited the Fair was highly satisfactory—in fact, it formed a rendezvous for men from all parts of the gas industry, and to it they were attracted by the fact that within the area of the Section they could see the best and most modern wares that our leading firms had to offer for the utilization of gas and coke and processes for the application of the other bye-products. We look back with pride upon the achievement, and its demonstration of the immense advances that the industry has made. For the organization of next year's display, through the initiative of the Society of British Gas Industries, a National Committee has been formed, which is fully representative of the entire industry. The report of the first meeting of the Committee was published in the "JOURNAL" last week (p. 301). It will be seen from it that the Committee is composed of twenty members. Naturally, the Society of British Gas Industries have the greatest number—a round dozen; while the National Gas Council, The Institution of Gas Engineers, the British Commercial Gas Association, and the Birmingham Corporation Gas Department have each two representatives. The Society of British Gas Industries supplies the Chairman, Mr. R. B. Hodgson; and Mr. A. W. Smith, General Manager of the Birmingham Corporation Gas Department, is the Vice-Chairman. Mr. R. J. Rogers again takes the post of Hon. Secretary, for which he has shown himself time and again to be extraordinarily gifted in respect of those essential qualities—organization and hard drive. The early movement for the next Gas Section is a favourable point; and, in view of it, it is hoped that the demands upon Mr. Rogers' capacity for work will be lightened by the prompt support of those who will desire to exhibit.

The composition of the Committee gives safe ground for anticipating that larger ideals, bigger materialization, and still more extensive patronage of the Fair from within the gas industry, will result in 1929 than in 1928. Apart from the effects within the industry, there are those valuable ones which such a display must have upon business men who are drawn to the Fair from other industries. We agree thoroughly with Mr. Rogers' remarks at the first meeting of the National Committee, that the gain to our industry of such a display, where industrialists and business men gather in such numbers, cannot be gauged solely by the orders placed directly or indirectly as a result of participation in the Section. Last year's Fair, he says, "was visited by a large proportion of the business men of the country; and the keeping of the gas industry before them on a scale worthy of its importance must have a definite effect upon their outlook." Where our competitors are, there we must be. They must not be allowed to have a place in John Bull's shop window, unless we are there with our advances fully staged. Misconception is often bred in the minds of outsiders by want of contact; and the Gas Section at the Fair gives just the opportunity for making such contact with the men of other large industries who cannot be deceived when the testimony of real facts is before them as it was earlier this year, and we hope will be still more so in the period from Feb. 18 to March 1 next. It is important that the Organizing Committee should know betimes what will be the requirements in respect of superficial area. The sooner they are in possession of the information the better, in order that the necessary engagement may be entered into for what we want, and as near as possible to where it is desired it should be. On this point there need be no enlarging to emphasize its importance. Business men will know what we mean, and will aid the Organizing Committee by sending in applications for space immediately to Mr. R. J. Rogers at the Offices of the Corporation Gas Department, Council House, Birmingham.

The Cardiff Meeting.

Over 700 members have signified their intention to be present at the Cardiff meeting of the Institution of Gas Engineers. Those who have not yet made arrangements for hotel accommodation for the meeting will do well to read the reference to the matter which appeared on p. 318 of last week's issue of the "Journal."

Joint Premises for the Gas Industry.

What looks like a movement reviving the idea that the gas industry should have a central home for itself and its organizations, which would be a worthy representation of its importance in the industrial and domestic systems of our country, is found among the minutes of the last meeting of the Council of The Institution of Gas Engineers, which are published in another column. A paragraph states that the Secretary (Mr. Walter T. Dunn) reported that a Joint Premises Committee had been formed, consisting of two representatives each of the Institution, of the National Gas Council, and of the British Commercial Gas Association. A meeting had recently been held presided over by Sir David Milne-Watson, when certain information was presented and discussed.

A Generous Donation.

Mr. Henry Woodall, sen., who joined the old British Association of Gas Managers in 1865, and is therefore the oldest surviving member of our central professional organization, has sent a cheque for £100 to the Benevolent Fund. On behalf of the Institution, the Council have thanked Mr. Woodall for his generosity, and have decided that the donation shall be invested, so that there will be a permanent reminder of, not only his generosity, but his good wishes for the chartered Institution of Gas Engineers when it becomes duly constituted.

Institution Membership.

According to an announcement in another column, the time is now limited for those members of the gas profession who desire to become members of the Institution of Gas Engineers without having to undergo an examination, or obtaining admission under the exempting or qualifying clauses of the By-Laws of the Royal Charter, the petition for which has been deposited with the Privy Council. The last meeting of the Council at which applications for membership under the old conditions will be considered, will take place on May 21.

Coal Marketing Schemes.

Probably as a result of questions raised in the House of Commons and the protests of coal exporters, the central organization of the Five Counties Coal Marketing Scheme decided that the restriction on output should be raised by 2½ p.ct. as from May 1 from the original fixture of 65 p.ct. of the basic tonnage, which is the aggregate of the best monthly output during the last fifteen years. The 2½ p.ct., it is stated, will represent about 200,000 tons additional for May. The excuse as to the recent shortage for export purposes is that work ceased during the Easter holidays, and initial difficulties connected with the launching of the scheme were also partially responsible. The shortage seems to have been particularly felt in respect of Yorkshire hards and washed smalls. Owing to this, prices were advanced by 3s. 6d. for the former, and 2s. 3d. for the latter. It is claimed that troubles will now disappear. It is, however, expected that this month the restriction of production will make itself felt on inland prices. One Yorkshire coal owner states: "Roughly we have a debit of about 1s. a ton to work-off before we can start level. Therefore, an average rise of 2s. per ton on all coal produced is needed, and will presumably come about in order to put the coal industry once more on a reasonable paying basis." Thus the marketing scheme is expected to assist in raising inland prices, and at the same time allow reduced competitive charges for export coal. Another report mentions that the Cannock Chase coal owners have increased their prices from May 1 by 1s. 6d. to 2s. per ton; this being due to the fact that as the restricted output of pits as fixed under the marketing scheme is inadequate to meet present requirements, the owners can demand higher prices.

Coalite.

Low-Temperature Carbonisation, Ltd., have lately been widely advertising "Coalite" in the public Press. The advertisement states that "Coalite" gives some friendly glowing flames, but far more heat than coal, and far more fires per ton. In fact, it is alleged that a ton of "Coalite" will go as far as a ton-and-a-half of coal. When one looks at the relative efficiencies which have been realized by competent authorities, there is some difficulty in seeing how a ton of "Coalite" can do as much work as a ton-and-a-half of coal. Perhaps the explanation which would be given is found under one of the illustrations in the advertisement. It states: "All the heat of Coalite goes out into the room. None goes up in smoke." While it may be true that "none goes up in smoke," it is not true to say that all the heat of Coalite goes out into the room, inasmuch as a large percentage of the heat must go up the chimney with the products of combustion. The statement is not one which can be scientifically defended; and it is a pity that it should be made with a view to obtaining public favour. If it were true that all the heat of Coalite goes into the room, then Low-Temperature Carbonisation, Ltd., could claim that a ton of Coalite is equal in heat value to four or five tons of household coal. The advertised cost of Coalite is 48s. a ton.

Compulsion on Housing Estates.

In the issue of the "Plumber and Decorator" for May 1, there is an editorial note concerning the action of those municipal authorities who are owners of electricity undertakings in attempting to compel tenants on housing estates to use electricity for the purposes of lighting, heating, and cooking. It reminds its readers that in March it protested against the imposed obligation. It made the point that, if a master may not compel his servant to purchase something in kind, why should a landlord, even though a municipal corporation, be allowed to do so. Reference is made to the attention which the subject has received in the columns of the "Journal;" and our contemporary ends its comment with the remark: "There has been quite enough spoon-feeding of the electrical industry without this infringement upon the rights of tenants." It hopes with us that questions in Parliament will bring the matter to a definite issue. The subject is one in which the National Gas Council are moving; and our contemporary may rest assured that nothing will be left undone which can be done to ensure that the tenants on municipal housing estates shall enjoy the ordinary freedom of citizens in making selection of whatever commodity they choose to purchase.

PERSONAL.

Mr. Thomas Armitage Orme, of Oldham, for many years Manager to Messrs. George Orme & Co., gas meter manufacturers, and a Director of Meters, Limited, left estate of the value of £38,959 (net personalty £38,401).

Mr. F. H. Rosencrants, B.Sc., Engineering Director of International Combustion, Ltd., Africa House, Kingsway, London, W.C., who has recently been out to Central and South America in connection with "Lopulco" pulverized fuel interests, states that there is a good deal of activity in connection with power station development throughout Latin America, and that considerable expansion may be expected to take place within the very near future.

OBITUARY.

The death is announced of Mr. Herbert Taylor, a former Manager of the Garstang Gas-Works.

Institution of Civil Engineers Awards.—The Council of the Institution of Civil Engineers have recently made the following awards in respect of papers read and discussed at the ordinary meetings during the session 1927-28: Telford Gold Medals to Dr. Oscar Faber, O.B.E., M.Inst.C.E. (London), and Mr. G. L. Watson, M.Inst.C.E. (Newark, New Jersey); Telford Premiums to Prof. John Goodman, M.Inst.C.E. (Skipton); Mr. James Williamson, M.Inst.C.E. (Wallington); Mr. R. M. Wynne-Edwards, D.S.O., M.C., B.A., Assoc.M.Inst.C.E. (Vancouver); and jointly to Mr. F. C. Vokes, B.Sc., Assoc.M.Inst.C.E. (Birmingham), and Mr. C. B. Townend, B.Sc., Assoc.M.Inst.C.E. (Birmingham).

ELECTRICITY SUPPLY MEMORANDA.

Power from Tropical Seas.

THE Central Electricity Board and the Electricity Commissioners had better stop at once their operations in devising schemes for the centralization of electricity generation and the transmission of the energy about the country. By the time the mammoth scheme is finished, it may be obsolete; and what is supposed to be in store may make their efforts look very puny. It may be the time is coming when all the electricity the world requires will be obtained from the tropical seas; and huge transmission schemes, instead of being confined to individual countries, will then be made on a world-wide scale. We are not going to pledge ourselves as to the accuracy of all this. The idea has been looked at with scepticism, which remains, despite toy-like proof of a certain reality. What the cost of the tropical sea derived electricity would be nobody has the slightest notion. But that does not at present matter. The story is simply this: Two French scientists, MM. Georges Claude and Boucheron, claim to have devised a system for utilizing an inexhaustible store of natural energy, which has hitherto remained untapped. What they assert they have discovered is that the difference between the temperature of the surface water and that near the sea-bed in tropical seas provides sufficient power to drive turbines. Some two years ago, and again last year, M. Claude interested the Academy of Science in a small experimental turbine, by means of which slight differences in temperature furnished power; the principle being that cold water drawn into a vacuum surrounded by warmer water boiled and gave off steam. A small plant has been established by M. Claude at Ongree, near Liége, which is driving a 50-KW. turbine by using a difference of 20° C. between the temperatures of two sources of water. In tropical seas, it is stated, the surface of the water has a temperature of about 35° C., while the water near the sea-bed is only 4° C. By using this difference for electricity generation, it is declared that, at an infinitesimal cost, unlimited quantities of energy for power and lighting can be distributed. The idea seems to be somewhat fantastical; but so did not very long since mechanical transport in the air. Anyway, much more information and experimental work will be needed before many people will be persuaded to sink capital in an enterprise to secure in the manner suggested electrical energy from the tropical seas.

From Fixed Price to Slot Meters.

Time after time it is found that, where a fixed price system for electricity is adopted, after experience of the disposition of human nature to use without stint a commodity which is not measured, but is paid for at a fixed price, wisdom dictates its abandonment. The general experience is that it does not pay. The Electricity Committee of the Hull Corporation have decided that, upon the Housing Committee serving the necessary notices to terminate the existing fixed price system of electricity charges, prepayment meters shall be substituted; and the change is to apply also to any additional houses which may be erected on the estate. It was always put forward as one of the considerations attaching to the fixed-price system that the capital expenditure on meters and the annual interest and sinking fund would be saved. But experience has frequently assured electricity suppliers that better the additional financial obligation for meters than the unknown monetary result—generally a loss—of the fixed price system in relation to energy consumption, the voracity of consumers always being an *x* quantity. Something as to the nature of the cost of the change to electric slots at Hull is found in the statement that, in order to enable the Electricity Committee to lay underground cables in a new portion of the estate, and provide prepayment meters for the whole of it, it is estimated that £11,749 will be required.

Domestic Water Heating.

In the "Memoranda" for April 11, comment was made on a letter which Mr. Edward Dixon contributed to the "Electrical Review," in which he showed that in his house he was satisfied that a coke-boiler was the cheapest method of dealing with the problem of hot water supply for household purposes. Naturally this did not please some of his electrical readers, and correspondence took place to which reference was made in these notes on April 25. Mr. Dixon takes quite good humouredly the attempts of his critics to show that he is wrong; but he is not in the slightest disturbed. There is no need for him to be; the strength of the case is on his side. Experience counts for much; and, in his further letter, he emphatically says: "For general heating, it is my experience that gas-fires for rooms and a coke and rubbish stove for hot water and central heating are the cheapest at present for the average householder, whom mass production of electricity hopes to serve." Mr. Dixon makes it clear that he cannot afford to be extravagant in these strenuous days of high taxation. He counsels his electrical friends to get domestic heating costs down to somewhere near a competitive rate with gas, and assures them that then they will rapidly develop that load. But, mark what he also says: "Even at 1d. per unit, electricity is still uneconomical to the average householder"—that is for heating purposes. But Mr. Dixon does a little to relieve the wounded feelings of his electrical friends by stating that he has no doubt that, when unit prices all over the country are down to 0·5d. or 0·75d. per unit, electrification in the house will become an essential habit; and this, it is hoped, will be brought about by real cheapness. But has he calculated that at 0·5d. or 0·75d. (or any other price) per unit, 29 units of electricity would be required to give 1 therm? Regarding the promised wonders in respect of electrification costs for the future, Mr. Dixon is still expecting that for long to come the promises and not the materialization will obtain.

Excitement at Dartmouth.

The "Dartmouth and South Hams Chronicle" is jubilant. It proclaims that "a new era in the progress and, in all possibility, the industrial prosperity of Dartmouth is opened up by the fact that the efforts of the Town Council to secure cheaper electricity have been crowned with success, and Dartmouth is now offered electricity for street lighting, private lighting, and probably workshop and factory power at much cheaper rates." Electricity is furnished in the borough by the Urban Electric Supply Company, Ltd., who are associated with Edmundson's Electricity Corporation. Described as "a valuable offer," it amounts to a general reduction from 1s. to 10d. per unit for lighting purposes, subject to the Company receiving a three years' contract for lighting the streets. A "well known business man" in the town is credited by the same local paper with saying this "is great news for Dartmouth." That 2d. reduction, leaving electricity still at 10d. per unit, we should regard as extraordinarily little to be cheery over. We should not look upon it as the inauguration of "a new era in progress," or as "a valuable offer," and not even "great news." We cannot see how electricity at 10d. per unit can create "a new era" in the progress of a town. It would require a miracle for it to do that. It has not been done elsewhere in areas that are better conditioned than Dartmouth for making progress. Tenpence per unit is really a big price to pay for such a small unit of potentiality. We know there is a difference between London and Dartmouth; but in London consumers grumble over their bills at 5d. and 6d. per unit; and where it is as much as 7d. per unit, they seem to suffer such agony that they have to relieve their feelings by writing to the "Daily Express."

A Street Lighting Condition.

We cannot say anything about the condition as to a three years' street-lighting contract, because we do not know the price or the illuminating value that is offered. But the Dartmouth Council should consider the street-lighting question from more points of view than the financial one. In these days of high-speed traffic, and during the bad weather of winter, the most reliable and penetrating light is required, and that light is provided by well-maintained incandescent gas burners. It is the duty of every local authority to see that the lighting in the streets is the best and most dependable available. But some local authorities forget their duty in this respect, and follow the craze for having something that is believed to be most modern. Gas and electricity are lighting agents; and both well advanced in years. It is nearly half a century ago that electricity was first seen in the streets of London, and gas has still a preponderance of the lighting. It is the means by which the two agents are used—and not the agents themselves—which should be judged from the point of view of modernity; and there are incandescent gas burners which are as modern as, and more effective in illumination and constancy than, any electric lamps.

A Cheerful Outlook.

There is good news for those who aspire to the creation, in the present, of a large, inconvenient, and erratic heating load for electricity undertakings. We are reverting to the Ice Age, and, when that arrives, it will give all the opportunity our electrical friends can desire. We cannot, of course, vouch for the truth of this; but "B. Simmons, jun.," of Forest Gate, appears, from a letter (dated April 16) in the "Daily Telegraph," to be willing to take all responsibility. The sudden return of winter, during a few days about the second week in April, is not surprising to him. When the change in the course of the Gulf Stream was reported several years ago, he pointed out that this would reduce our summers to vanishing point. With one exception, he believes, every year has proved the accuracy of his contention; and now he says definitely that the old-fashioned summer has gone, never to return. This cheerful prophet assures us that his own opinion is that Europe is slowly but steadily reverting to the Ice Age, and the change will doubtless be felt more severely as the years go on. So our electrical friends may take heart.

Nature is providing plenty of room for us all in the heating business—even for the most expensive heating agent known.

Overhead Lines.

Some engineers in the electricity industry appear to think that their undertakings should have the power to do practically what they like in the matter of transmitting electricity about the country. This especially applies to the question of overhead conveyance and the erection of poles for carrying cables. The industry now possesses an Overhead Lines Association, which some electrical engineers regard as a superfluity. The new body held a meeting at the Institution of Electrical Engineers on April 18. On the occasion, Mr. W. C. Bexon, of the Ayrshire Electricity Board, read a paper on "How far Wayleave Notice and/or Agreement Form can be Standardized for Great Britain." From the communication, we learn that the Electricity Commissioners' annual reports show that wayleave rentals vary from 10s. 6d. to 1s. for a standard wooden pole; but Mr. Bexon contends that there cannot be such a big difference in the value of land as to warrant this difference in wayleave rentals. He feels aggrieved that Clause 22 of the Electricity Supply Act of 1919 does not give the Minister of Transport any powers to authorize the placing of overhead lines over gardens or pleasure grounds; and he mentions that a certain town council in Scotland had refused to give permission to the Central Electricity Board to erect their grid transmission lines over a new housing site. We do not in the least blame the council. Why should the tenants on a new housing estate have the scene of their dwellings disfigured by huge standards carrying transmission cables? Why, too, should private persons have the amenities of their gardens or pleasure grounds destroyed by the placing of poles in them with wires running overhead? It is absurd to suppose that all private and public interests are to be subservient to the overhead method of transmitting electricity. Another cause of complaint by Mr. Bexon is that, in negotiating wayleave agreements, an electricity supply authority have been compelled to pay the legal expenses of the other side, varying from £10 to £25. Again, we ask, why should an individual upon whom the electricity suppliers are attempting to impose poles or standards and overhead cables, and whose property may be depreciated thereby, be expected to pay any part of the legal expenses involved for something which is for the convenience of the electricity suppliers, and probably to his own detriment? He has not asked for the poles to be erected on his property; so why should he pay any part of the legal expenses?

What Mr. Bexon Suggests.

The author of the paper suggests that the Government should immediately bring in a Bill to deal with wayleaves, embodying various conditions. In the first place, he urges that legislation should give undertakers the power to erect overhead lines, and in a case of dispute the matter should be referred to a local arbiter. Secondly, provision should be made for safeguarding undertakers from any frivolous obligations. Who is to determine what are "frivolous obligations?" The owners of property have a right to be safeguarded against the attacks of electricity suppliers, who, in order to save themselves additional expense, may do irretrievable damage to private property. In the third place, Mr. Bexon suggests that powers should be granted to authorized undertakings to enable them to erect aerial lines over, or lay cables under, railways, canals, &c., without the present cumbersome procedure. He further urges that electricity suppliers should have the same facilities as a local authority under the Police Burgh (Scotland) Act, 1892, to erect public lamps on any building, and, lastly, he suggests that, in regard to Post Office regulations, electricity undertakings should have the same facilities as the Post Office in the erection of overhead lines. Later in the paper it is found that Mr. Bexon's standard wayleave agreement, which has been accepted by owners and tenants in regard to some 200 route miles of overhead lines, provides for an annual wayleave rental of 1s. per pole per annum in grass, 1s. 6d. per pole per annum in corn, and 2s. 6d. per pole per annum in green crop to the farmer, with a payment of 1s. per pole per annum to the landlord. It is understood that the Overhead Lines Association intend to draw up some concrete proposals for submission to the Electricity Commissioners. In this work it is hoped they will look out upon the world from other platforms than, as now, the one of selfishness.

Mishaps.

According to evidence given at an inquest on Charles Bitchener, electrical engineer, employed by the Hampstead Borough Council, his death took place, at an underground substation, through a spanner he was using touching a live terminal. Another instance of the danger of overhead transmission, unless adequate precautions are taken to prevent the climbing of the poles, has been supplied by the death of Frederick Bryant, age 16, of Enfield, who had climbed a pole carrying an overhead electric line, conveying current at a pressure of 33,000 volts. He was electrocuted. A boy who was with him at the time stated that, when Bryant got to the top of the pole, there was a flash and an explosion, and he fell to the ground. A representative of the North Metropolitan Electric Power Supply Company stated that, in addition to a red danger notice, the bottom of the pole was protected with barbed wire and a row of spikes. Last Saturday week, Frederick Yates, a Barnsley labourer, was electrocuted, at a transformer station near Doncaster, by coming into contact with one of the power cables. Last Wednesday week, a few minutes before 8 p.m., the electricity supply at Hastings suddenly failed over the whole system, including Bexhill and other districts. The current was only off for about eight minutes. The explanation as to the failure is that it was caused by a valve breakdown in the steam turbine, and another turbine had to be started before the supply could be restored. It is reported that the Earl of Cranbrook received slight facial burns in a fire on May 3 at Rosetti Garden Mansions, Chelsea, which was caused by a defective electric circuit.

NOTES ON NEW BOOKS.

THE THEORY OF THE REDUCIBLENESS OF BITUMINOUS-COAL COKE.

"Theorie der Reduktionsfähigkeit von Steinkohlenkoks" is the title of Vol. 18 of the "Kohle Koks Teer" series published by Wilhelm Knapp, of Halle (Saale). The authors are Prof. Dr. G. Agde, of the Darmstadt Technical University, and Dr. H. Schmitt, of Ludwigshafen. They have combined a detailed study and appreciation of all contemporary literature upon the subject with an account of their own practical research, and their work is a valuable contribution to the very topical subject of the properties of coke. It is published at the price of Mk. 16.50 in paper cover, or Mk. 18.50 bound.

PROGRESS OF APPLIED CHEMISTRY.

Annual Reports of the Society of Chemical Industry.

Vol. XII. (1927), Annual Reports on the Progress of Applied Chemistry, has been published by the Society of Chemical Industry, at 7s. 6d. net to members, and 12s. 6d. to non-members; and once again there is a feeling of gratitude to the Society for issuing this compact and lucid record of scientific developments in the field of industry.

The arrangement of the volume follows precedent, and it is unnecessary, therefore, to detail the different sections. The portions of the book particularly interesting to those connected with the gas industry are "General, Plant, and Machinery;" "Fuel;" "Gas, Carbonization, Tar, and Tar Products;" "Acids, Alkalis, Salts, &c.;" and "Refractories, Ceramics, and Cements"—which sections are in the capable hands of A. J. V. Underwood, T. Campbell Finlayson, J. E. Davis, P. Parrish and F. C. Snelling, and A. T. Green respectively.

Mr. Underwood, in considering co-operation between employers and employed, refers to the success of co-partnership schemes in the gas industry, and mentions the efforts of Imperial Chemical Industries, Ltd., in this direction. His observations on the synthetic nitrogen industry do not make the outlook for sulphate of ammonia any more promising. The aim in Britain alone is to produce 70,000 tons of synthetic nitrogen this year, and it is intended to double this capacity as rapidly as possible. The present German production is about 500,000 tons annually. It is suggested that future extensions of the fixed nitrogen industry, both in Germany and in England, are likely to be in the direction of manufacturing mixed fertilizers rather than ammonium sulphate. Mr. Underwood, discussing power production, states that the consumption of electricity in Great Britain during 1927 was greater by 25 p.ct. than during 1926; the rate of increase being higher than in any other country. Translated into therms, of course, this increase is exceedingly small compared with the growth in therms sold by the gas industry during 1927.

Mr. Campbell Finlayson's contribution is really an extended bibliography. He says that the "striving for co-ordination may be taken as the keynote of the year's activities in fuel," and mentions Prof. J. W. Cobb's suggestion that fuel technology should be established as a new profession.

The résumé by Mr. Davis, of the South Metropolitan Gas Company, is comprehensive; reference being made to practically all the interesting developments of the year. Basing his remarks on the paper which Mr. Thomas Carmichael presented at the annual meeting of The Institution of Gas Engineers, the author, while suggesting that there is little to choose between the costs of gas production in verticals and horizontals, is of opinion that a modern horizontal setting with equally good coal would prove superior to vertical retorts as regards cost. Refractories, water gas and producer gas, low-temperature carbonization, hydrogenation, coke, quenching, tar, ammonia, purification, drying of town gas, combustion, and testing and analysis are dealt with in turn.

INSTITUTION MEMBERSHIP.

We are asked by Mr. Walter T. Dunn, Secretary of the Institution of Gas Engineers, to state that the last meeting of the Council (before the Annual Meeting at Cardiff) at which applications for membership will be considered takes place in London on May 21. The names of candidates then approved will be included in the ballot list which is to be issued on May 24. Candidates after that date will be required to enter the Institution by examination only, or under the exempting or qualifying clauses of the By-Laws of the Royal Charter, the Petition for which has been duly completed, and deposited with H.M. Privy Council for their consideration. It is hoped that the Cardiff meeting will be the first Annual Meeting (under the Presidency of Mr. H. D. Madden, M.Inst.C.E.) to be held under the terms of the Royal Charter. Over seven hundred members have signified their intention of being present at this meeting.

SCIENTIFIC, DOMESTIC, AND ILLUMINATING GLASSWARE, &c.

Merchandise Marks Act, 1926.

The Board of Trade have referred to the Standing Committee an application for the marking, with an indication of origin, of the following descriptions of imported goods:

Domestic, fancy, and illuminating blown glassware of all descriptions (other than electric lamp bulbs).
Pressed glassware of all descriptions.
Bottles, jars, and other containers of glass.
Lampblown ware and scientific glassware of all descriptions, including tubing and rod.

The Committee will consider whether these articles should be marked on sale or exposure for sale, and they may, at their discretion, also consider whether the articles should be marked on importation.

The date of the Committee's public inquiry will be announced later, and communications should be addressed to the Secretary, Mr. E. W. Reardon, Board of Trade, Great George Street, S.W. 1, as early as possible, and in any case not later than May 25.

ACTIVITIES OF THE BRITISH ROAD TAR ASSOCIATION.

Exhibit at Blackpool.

It is only natural, with the present-day widespread movement for increasing the adoption of British goods, that some effort should be made to support the use of British tar—a material which made possible the earliest step taken towards the construction of roads on the lines upon which they are to-day formed. Tar is adaptable to any form of road work, from the simplest resurfacing to the entire reconstruction of the highway. Its many advantages for economical and durable construction, together with the additional advantage of a permanent non-skid surface for these various uses, are rapidly making it the premier road-making material of the country.

In order that the advantages should be made more widely known, the British Road Tar Association are participating in all exhibitions connected with road-making activities, and will be in evidence at the Exhibition of Quarrying Plant and Machinery to be held at Blackpool from June 2 to 9. The theme of the display on this occasion will be a comprehensive survey of the use of tar for road-making. It will include samples of No. 1 and No. 2 road tar; British aggregates in the tarred and untarred state used for road construction; sections taken from experimental roads constructed with tar, and sections from tarmacadam roads; and scientific instruments used in the testing of tar. There will also be a selection of photographs illustrating the value of all-British materials for road construction, and some interesting literature on the tar treatment of roads. A conspicuous feature will be the Association's tar viscosity demonstration apparatus, which will provide a continuous demonstration and indicate, at a glance, those desirable properties necessary in tar for road-making purposes.

A cordial invitation is extended to all highway authorities, and others interested in road construction, to visit the stand and discuss any problems relating to the tar treatment of roads.

Annual Meeting of the National Gas Council.—The tenth annual general meeting of the National Gas Council of Great Britain and Ireland is to take place at 3 o'clock on Tuesday, May 22, at the Hotel Cecil, Strand, W.C., when the report and accounts will be submitted by the President (Sir David Milne-Watson, LL.D., D.L.) for adoption. Competent business includes the consideration of the report of the Committee on Gas Charges.

FORTHCOMING ENGAGEMENTS.

[*Secretaries of Gas and Kindred Organizations are asked to assist in making this diary of events as complete and useful as possible by sending the earliest intimation of all meetings.*]

May 10.—SOUTH-WESTERN DISTRICT EXECUTIVE BOARD OF THE NATIONAL GAS COUNCIL.—General meeting at the Gas Offices, Exeter, 2.45.

May 10.—MIDLAND JUNIOR GAS ASSOCIATION.—Annual general meeting.

May 11-15.—SOCIETY OF CHEMICAL INDUSTRY.—Conference in London, organized by the Society in co-operation with its London Section and Chemical Engineering Group and the Institution of Chemical Engineers.

May 16.—BRITISH COMMERCIAL GAS ASSOCIATION.—Meetings of the Executive Committee at 11 o'clock, and of the General Committee at 2.30, at 28, Grosvenor Gardens, S.W. 1.

May 16-17.—EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.—Meeting at Bedford.

May 17.—SOCIETY OF BRITISH GAS INDUSTRIES.—Annual general meeting at the Hotel Cecil, W.C. 1, under the presidency of His Grace the Duke of Sutherland.

May 18.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS.—Visit to the works of the Rochester, Chatham, and Gillingham Gas Company.

May 19.—SCOTTISH JUNIOR GAS ASSOCIATION (EASTERN DISTRICT).—Annual general meeting in Edinburgh. Presidential Address of Mr. E. L. Farquhar.

May 19.—YORKSHIRE JUNIOR GAS ASSOCIATION.—Meeting at Elland. Paper on "Coke" by Mr. R. Crowther.

May 21.—COKE CONFERENCE, Grosvenor Hotel, Westminster.

May 22.—CENTRAL COMMITTEE OF THE FEDERATION OF GAS EMPLOYERS.—Meeting at the Hotel Cecil, 10.30.

May 22.—CENTRAL EXECUTIVE BOARD OF THE NATIONAL GAS COUNCIL.—Meeting at Hotel Cecil, 11 o'clock.

May 22.—FEDERATION OF GAS EMPLOYERS.—Annual general meeting at the Hotel Cecil, 2.15.

May 22.—NATIONAL GAS COUNCIL.—Annual general meeting at the Hotel Cecil, 3 o'clock.

May 23.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS (EASTERN DISTRICT).—Meeting at No. 28, Grosvenor Gardens, S.W. 1, at 2.30.

May 24.—BRITISH COMMERCIAL GAS ASSOCIATION.—Conference of the Cornish District at Truro.

May 24.—MIDLAND ASSOCIATION OF GAS ENGINEERS AND MANAGERS.—Spring general meeting at Willenhall.

June 11.—BUTE LODGE.—Emergency meeting to welcome the masonic members of The Institution of Gas Engineers.

July 4-5.—ASSOCIATION OF STATUTORY INSPECTORS OF GAS METERS.—Annual conference in Birmingham.

THE INSTITUTION OF GAS ENGINEERS.

All meetings take place in the Council Room at 28, Grosvenor Gardens, unless otherwise stated.

May 21.—Emergency Committee meeting at the Grosvenor Hotel, Westminster.

May 21.—Finance Committee meeting at the Grosvenor Hotel, Westminster.

May 21.—Council meeting at the Grosvenor Hotel, Westminster.

May 21.—Benevolent Fund Committee of Management meeting at the Grosvenor Hotel, Westminster.

May 21.—Luncheon to the President, by invitation of the Council, at the Grosvenor Hotel, Westminster.

May 22.—Gas Investigation Committee in morning; Effluents Committee and Sulphate of Ammonia Committee in afternoon.

June 11.—Council meeting at the Park Hotel, Cardiff.

June 11.—Dinner to the Council, by invitation of the President, at the Park Hotel, Cardiff, Sir David Milne-Watson, guest of honour.

June 12.—Council meeting in the Cory Hall, Cardiff.

June 12-15.—Annual General Meeting at Cardiff.

June 14.—Council meeting in the Cory Hall, Cardiff, for the appointment of Committees for the year 1928-29.

July 10.—Gas Education Committee.

Oct. 9.—Gas Education Committee.

Nov. 13.—Executive Committee of Gas Education Committee.

Dec. 11.—Executive Committee of Gas Education Committee.

NEW SHOWROOM AT BOSTON.

The accompanying illustrations show the new showroom recently opened by the Boston Gas Light and Coke Company, in the Market Place, Boston. The whole of the ground floor of the premises was originally used as a drapers' shop, but recently became available for other purposes, and was converted into two shops by the construction of a central partition. The site being one of the most central and prominent in the town, the Gas Company secured one of the shops for the purpose of a showroom, with the result shown in the illustrations.

After careful and detailed consideration by the Directors, advised by their Engineer and Manager, Mr. J. Stewart Dougall, the work was entrusted in its entirety to the Nautilus Company of London and Luton, who are specialists in this class of architecture. The original shop front was in line with the front of the main building. To obtain an improved effect, it was decided to set-back the showroom front, thus forming a loggia, as shown. The front and pier-casings are in teak with a Tinos marble plinth and Terrazzo paving. The facia above is in cream "Vitrolite" in teak frames and gilt wood letters.

The showroom itself is divided into four sections—viz., the window enclosure, gas-fire section, cooker and geyser section, and office. The window enclosure is formed with oak screens for changeable displays of gas apparatus as desired. The front portion behind the screen is arranged for the display of gas fires; the wall being treated with oak skeleton framing and leather paper panels, with oak chimney pieces and tiled surrounds and hearths, to display gas fires, a number of which are in use.

The middle portion is allocated to the display of gas cookers, geysers, &c. On the left-hand side is shown a kitchen fire-place, all in white glazed tiles, illustrating the most up-to-date arrangement of gas apparatus for the domestic kitchen.

One of the features in regard to the internal lighting is the introduction of Sugg ventilating ceiling lights alternating with Sugg "Majestic" indoor lamps fitted with distant control device.

The whole scheme is most pleasing and shows a variety of gas apparatus to the best advantage, enabling the customer to see how artistic gas fires and apparatus generally can be made.

The external lighting is by Sugg "Rochester" 1000-c.p. cluster inverted lamps.

The provision of the showroom meets a long-felt need on the part of both the Company and the public, who have not been slow to appreciate the convenience offered.

Air Pollution by Motor Traffic.—In a paper to the Académie des Sciences (we learn from the "Journal des Usines à Gaz) the Assistant Director of the Paris Municipal Laboratory set out the results of two years' observations of the Paris atmosphere. Careful analyses were made in various districts and at different elevations; and it was definitely established that pollution was far greater in the City itself than in the outskirts and suburbs. At ground level there was an average of three parts in 10,000 of carbon dioxide and one part in 20,000 of carbon monoxide; and these proportions showed signs of diminishing only at the third storey of buildings. It was pointed out in the paper that the lower floors of City buildings should not be used as dwellings, owing to the considerable volume of combustion products; further, that air for central heating purposes should be entrained, if possible, from a high level.

THE INSTITUTION OF GAS ENGINEERS.

Council Meeting.

A Meeting of the Council was held at 28, Grosvenor Gardens, on Monday, April 23. In the regretted absence of the President, Mr. H. D. Madden, owing to illness, the chair was occupied by the Senior Vice-President, Mr. JOHN TERRACE. There were also present: Messrs. C. S. Shapley (Leeds), Junior Vice-President, C. Rhodes Armitage (London), W. H. Bennett (Redhill), Harold E. Copp (Hull), J. Herbert Canning (Newport, Mon.), Harold C. Smith (Tottenham), Thos. Carmichael (Portsmouth), Ralph E. Gibson (Liverpool), Robert Robertson (Bristol)—ordinary members of Council; Mr. Francis C. Briggs (Midland Association), Mr. Chas. F. Botley (Past-President), Mr. W. E. Price (Hon. Secretary), and Mr. Walter T. Dunn (Secretary).

Regrets at absence were received from Messrs. Leonard J. Langford (Tunbridge Wells), W. Eames Caton (Oxford), Phillip G. G. Moon (Bournemouth), W. J. Smith (Bolton), Frank Prentice (Ipswich), W. Millar (Cookstown, Ireland), H. H. Gracie (Edinburgh), Herbert Lees (Hexham), T. Hardie (London), A. T. Kyle (Abergavenny), John Wilkinson (Nottingham), and J. Ferguson Bell (Derby).

The minutes of the previous meeting having been read, confirmed, and signed, it was resolved that a telegram conveying the sympathy of the Council with the President in his illness be dispatched to him.

It was announced that a letter had been sent to the Prince of Wales, Honorary Life Member, conveying the congratulations of the Institution on his appointment as Master of the Company of Master Mariners. The appreciative reply of His Royal Highness was read.

DEATHS.

The Council rose in sympathy at the intimation of the deaths of Mr. Peter Robinson, Editor of the "Gas World" (a floral tribute had been sent, and the Institution had been represented at the funeral by the Secretary, Mr. Dunn); Mr. John Hughes, of Hoylake; Mr. John W. Thompson, of Barnoldswick; and Mr. Edwin C. Sayer, of Ipswich (members); and M. and Mme. Arthur Martin, who were instantaneously killed in a motor-car accident.

The following were approved as candidates:

MEMBERS.

FROST, ARNOLD EDWARD, Engineer and Manager, Churnet Valley Gas Company.

HEELEY, GEORGE VICTOR, Engineer and Manager, Milton Regis Urban District Council.

HIGGS, JOHN NICHOLLS, Engineer and Manager, Swanage Gas and Electricity Company.

HOPKINSON, CHARLES HENRY, Manager and Secretary, Gas and Coke Company, Lymington.

THOMAS, WILLIAM GEORGE, Engineer and Manager, Mountain Ash Urban District Council.

WILSON, ANDREW, General Manager and Secretary, Australian Gas Light Company, Sydney.

ASSOCIATE MEMBERS.

ALLAN, OSWALD, Works Superintendent, Rio de Janeiro.

BARCLAY, WARREN, Assistant Engineer, in charge of coal gas manufacture, Beckton.

BARROW, CHRISTOPHER FRASER, Distribution Superintendent, Sunderland.

BERTRAM, DAVID CRAIG, Engineer, in charge of four retort houses. Gas Light and Coke Company, Beckton.

CUNNOLD, CLIVE CLEMENT, A Works Officer (Junior Member of Engineering Staff), Gas Light and Coke Company, Beckton.

HALL, JOHN STRADLING, Assistant Manager to the Prescot Gas Company.

LEE, ALBERT SAMUEL, Engineering Assistant at Commercial Gas Company.

MEAD, TENNETH CHARLES, A Works Officer (Junior Member of Engineering Staff), Gas Light and Coke Company, Beckton.

MONROE, COLIN RONALD, Engineer Assistant to the Cardiff Gas Light and Coke Company.

PINDER, FRANK, Manager, Welwyn and Hatfield Gas Company.

SANTLER, FRANK WALTER RING, Engineer's Assistant, Malvern.

TAYLOR, CHARLES EDWARD, Manager, Grafton Lighting Company, Grafton, New South Wales.

WHITE, WILLIAM, Manager and Secretary, Saffron Walden Gas Department.

WILSON, REGINALD JAMES WEIR, Mechanical Engineer, Tottenham District Light, Heat, and Power Company.

WOODMAN, DONALD LEWIS, Station Clerk (Technical), Rotherhithe Works, South Metropolitan Gas Company.

The following was transferred to the class of member of the Institution: Gould, John Alexander, M.C., London.

The Council admitted as Students of the Institution: Messrs. Jack Pollard (Burnley), and Robert Morton (St. Austell).

A request from the Royal Sanitary Institute for the co-operation of the Institution on the need for research in connection with the purification of sewage was referred to the Effluents Research Committee.

It was reported that the next annual meeting of the Swiss Association of Gas and Water Engineers would take place from Sept. 22 to 24.

A letter was read from Mr. Henry Woodall, who joined the Institution in the year 1865, when it was under the name of the British Association of Gas Managers, expressing to the Secretary his personal thanks for the reception given to him on the occasion of the Royal Charter meeting on April 2, and enclosing a cheque for the sum of £100 for the Benevolent Fund of the Institution. It was resolved that the cordial thanks of the Institution be conveyed to Mr. Woodall, and that the donation be invested so that there might remain a permanent reminder of his generosity and good wishes for The Chartered Institution of Gas Engineers, when it became duly constituted.

It was reported that the Southern Association of Gas Engineers and Managers had elected Mr. C. Valon Bennett, of Rochester, as the representative of that Association on the Council of the Institution for the year 1928-29.

Invited by the British Engineering Standards Association to nominate a representative of the Institution to serve on the Sub-Committee 10-5 Metal Tubes and Connections, it was resolved that Mr. Albert Stokes, Chairman of the Wrought-Iron Tubing Committee of the Institution, be nominated to serve.

The progress made with the preparation of the Petition, Charter, and By-Laws for presentation to the Privy Council was reported.

NEW OFFICERS.

It was resolved that the following be nominated for service for the year 1928-29:

President.—Mr. John Terrace (London).

Senior Vice-President.—Mr. Charles S. Shapley (Leeds).

Junior Vice-President.—Mr. Harold E. Copp (Hull).

Members of Council.—Messrs. Harold E. Bloor (York), Fras. C. Briggs (Dudley), Lt.-Col. W. M. Carr, M.C. (Stretford), Harold Davies (Chesterfield), G. S. Frith (Runcorn), Frank P. Tarratt (Newcastle-upon-Tyne), W. W. Townsend (Colchester), and J. Wesley Whimster (Bath).

REPORTS.

A report by Mr. T. Hardie on the work of the World Power Conference Technical Committee was submitted. Mr. Botley reported on what had been done by the Joint Fuel Committee, on which the Institution was represented; and several names of authors of papers for the World Power Conference were suggested to him by the Council.

The report of the Gasholder Construction and Deterioration Committee was presented by Mr. Shapley, and a letter from Mr. Stanford, of the Ministry of Health, expressing his thanks for what Mr. Shapley had done on behalf of the Institution at the Manchester inquiry into the causes of the accident there, were read.

Mr. Botley presented the latest report on the work of the Effluents Committee, and reported a request received from the National Gas Council that the Institution should appoint a Committee to consider the question of sulphate of ammonia, with a view to making such arrangements as would ensure an adequate return for sulphate when offered for sale by gas undertakings throughout the kingdom. It was agreed that the Council should do all in their power to promote the success of this proposed new investigation.

The report of the National Illumination Committee of Great Britain for last year was presented, accepted, and adopted.

The Hon. Secretary reported the present condition of the arrangements for the Cardiff meeting, as arrived at by the Reception Committee at Cardiff recently, under the Chairmanship of the President of the Wales and Monmouthshire District Institution of Gas Engineers. A Ladies' Reception Committee had been formed, of which the Lady Mayoress had graciously consented to act as Chairman.

The report of Mr. W. J. Smith (Bolton) on the Analysis and Sampling of Coal Committee of the British Engineering Standards Association was received.

It was resolved that Mr. John Terrace (President Designate) and Mr. W. E. Price (Hon. Secretary) be appointed to represent the Institution at the British Industries Fair, 1929, on the British Gas Industries Exhibition Committee.

In response to the request of the Association of Public Lighting Engineers for the President of the Institution to attend the annual meeting and conference to be held at Sheffield in July

next, it was agreed that a favourable reply be returned, and also that Mr. Ralph Halkett, of Sheffield, be asked to accompany Mr. Terrace.

The report of the Education Scheme to date was presented, indicating the number of candidates who had registered their names to sit for the examinations taking place on Saturday, April 28.

It was agreed that Mr. W. Dieterichs be nominated to serve as Chief Examiner to the City and Guilds of London Institute, in Gasfitting, to fill the vacancy unhappily caused by the death of Mr. R. H. Francis.

In the absence of the President, the Secretary presented the report on the programme of papers, &c., for the Cardiff meeting, including the visits on Friday, June 15, which was approved. It was supplemented by information given by Mr. J. H. Canning, a member of the Reception Committee.

The Secretary also reported that a Joint Premises Committee had been formed, consisting of two representatives of the Institution, of the National Gas Council, and of the British Commercial Gas Association. A meeting had recently been held, presided over by Sir David Milne-Watson, when certain information was presented and discussed.

It was resolved that the Council invite the President to luncheon with them at the Grosvenor Hotel, Victoria Station, on Monday, May 21, previous to their usual business meeting.

A conference on the subject of Coke Sales and Regulations was arranged to be held at the same place in the afternoon subsequent to the Council Meeting.

IS GAS-LIGHTING DEAD?

By R. S. Ross.

Arising out of a discussion upon my recent article with reference to the lethargy in present-day gas lighting (see "JOURNAL" for March 28, p. 798), it was suggested to me that this attitude was not so much accidental as studied. The argument was that the psychology of the consumer was such that to mention lighting in conjunction with other apparatus was not wise, because—mark this well—the consumer might get the impression that the other apparatus was as old-fashioned as his idea of lighting. It is hard to conceive that this statement can have any foundation in fact, but I am assured that it is actually true. If it is so, no wonder gas lighting is in the state it is at present. No wonder we are losing heavily every day. Out of our own mouths have we been condemned. It almost makes those of us who have lighting at heart ask "What is the use? Why, oh why won't they fight for it? Can nothing be done to make those who are responsible for the lighting realize what they are losing, and whither they are drifting?"

There are a certain number who even hold the view that, if they do lose the lighting, what does it matter? Lighting loads are usually the smallest—almost negligible to some minds—but what of the moral effect of retaining lighting against all competition? Gas lighting is irrevocably bound up with the gas industry in the mind of the public. Let it waste into decay, and the industry will suffer. Make it efficient and live, as it can be made, and gas will benefit.

Some companies—alas, too few—refuse to accept the so-called inevitability of the lighting loss, and they are doing their utmost to recover for us some of the wreckage of the past. One London company I know refuse to accept the invitation to the obsequies of lighting, and they are resolutely fighting; and, what is more, they are winning. By adopting simple business methods to cope with the present-day conditions, they are not only retaining their lighting, but are actually increasing it. Here is a complete answer to our apologists. They know they can light adequately and cheaply; and a business man needs little convincing when it is put to him that he can reduce his overhead expenses without sacrificing efficiency. Proving the success of their methods in business premises, they have gone a step further, and have given their private consumers the benefit of hire lamps. The householder is thus enabled to enjoy the benefit of modern fittings and to have them maintained at a very small cost. It is only by this maintenance system that we can hope to hold the lighting. It has been proved in this instance that it can be done; but to make it the perfect success, it needs first of all untiring supervision, coupled with which must go expert attention, and the erection of modern fittings. When a consumer is satisfied, and kept satisfied, then there is very little fear that he will be overwhelmed by the glamour and incessant propaganda of our competitors. In further refutation that lighting is dead, this company in numerous instances take out electricity and reinstate gas. I am sorry to have to prove that numbers of our members are false prophets, but there it is—hard and solid fact.

I look in vain in the daily Press for any announcement or advertisement advocating gas lighting. Cookers, fires, geysers, and other apparatus are all advertised regularly—and I hope successfully—but I am afraid I must accuse our gas propagandists of an almost biblical outlook, for they are "hiding our light under a bushel." Actually—apart from the moral effect—this lack of public advertisement is of little moment. The question is one which must be grappled with by the companies themselves, but it will never be done until the timidity is shaken off, and the will to fight substituted, the indifference rooted out, and, above all, the fact brought home to those responsible that gas lighting is worth fighting for.

Some companies are doing it, and doing it well; but the industry will be judged by the world at large on the inferiority of the many, not on the superiority of the few. May the day be far off when the gas industry, having lost the lighting, will be striking its breast saying *mea culpa, mea culpa, mea maxima culpa.*

DAYLIGHT AND ARTIFICIAL LIGHT.

In a paper before the Illuminating Engineering Society at a meeting at the Home Office Industrial Museum on April 24, Mr. J. S. Dow said that, in making comparisons between natural and artificial light, one finds traces of two distinct schools of thought. There are some who, regarding daylight as the ideal, suggest that artificial lighting should be an imitation of it. In some cases the outlook has been carried so far as to attribute an alleged deterioration of eyesight to the ever-increasing use of artificial light. Regarding this, Mr. Dow said he had never been able to obtain any satisfactory evidence that a general deterioration in eyesight is proceeding; still less that this is due to artificial light.

The other school of thought regards artificial lighting as something radically different from natural lighting, possessing the great advantage of being under man's control and capable of much greater variation. Its exponents aim at ultimately furnishing artificial lighting even better than that normally obtained through the access of daylight into buildings—far more constant and uniform, capable of infinite adaptation according to the process it serves, and offering a new field for the creative efforts of the artist. Artificial lighting thus regarded must necessarily develop on lines different from natural lighting.

There are, continued Mr. Dow, two qualities of daylight which are probably of great importance: First, the nature of the visible spectrum, and, secondly, the presence of a proportion of ultra-violet energy. Even in winter the latter is probably much greater than the minute proportion of such energy in ordinary artificial illuminants. There are some who contend that the excess of yellow and orange in the spectra of most artificial illuminants is harmful to the eye. While there is no need for any alarmist view of this difference, the influence of *quality* as distinct from *intensity* of illumination on vision is certainly a matter that deserves research. This is chiefly a matter for the physiologist.

In the case of domestic lighting, Mr. Dow is of opinion that few people would desire to make the artificial lighting a perpetuation of daylight. When the day is ended, it is a distraction and a relief to turn to a different system. The general preference for a mellow yellow light is deep-seated. Except in rooms where serious work is done, an order of illumination lower than that of daylight is probably justified.

The transition from natural to artificial light leads one to consider the awkward problem, familiar in most offices and factories, of the "transition period" from natural to artificial light, and particularly the difficulty of working in a "mixed" light. Mr. Dow has given some study to this question, and believes that the difficulty is not due primarily to the difference in the spectrum of natural and artificial light, though this may be a contributory factor. The suggestion has frequently been made that some form of automatic indicator should be contrived (*e.g.*, based on the use of a selenium cell) to sound a signal when daylight has become inadequate and artificial light is needed.

The conclusion seems to be that one of the chief factors in creating uneasiness during the period of waning daylight is the progressive diminution of natural illumination. This difficulty is not overcome even by using supplementary illumination which is visually a match for the daylight. Much of the difficulty in working by a mixed light probably arises from the fact that the added artificial illumination is too low. If general artificial illumination of the order of (say) 10 foot-candles were employed, this would usually serve to "swamp" the psychological effect of diminishing daylight. It might even be expedient to draw the blinds, and make an abrupt change to such conditions, even if this occasioned a certain period of adaptation of the eye to the new conditions.

THE "METHODIST TIMES" GOES ASTRAY.

The Falsehoods of a "Prize Entry."

It is scandalous that such papers as the "Methodist Times" should accept and publish matter regarding the truth of which the Editor is apparently totally incompetent to form any opinion. To give circulation to such grossly false information as appears in what is called the "Prize Entry, by E. Wells, Wolverhampton," headed "Points for and Against the Use of Gas Fires in the Home" (published on March 22), should cause the proprietors of the paper to be brought to book for trade slander at the instance of every gas undertaking who can prove damage to its business as the result of the publication of the untrue and defamatory statements contained in it. We are enjoined not to bear false witness. The "Methodist Times" above all papers ought to see that the injunction is obeyed in all matters. The command carries with it the personal obligation, before bearing witness, to do everything possible to ensure its accuracy. This the "Methodist Times" did not do in this case.

The "Prize Entry" is one of the most singular things we have ever come across. Though we cannot give up space to dealing point by point in the columns of a technical paper with the childish statements, we will treat, by way of example, with two or three. We read—

> There are many reasons for and against gas-fires in the home —more against than for them. The main point in their favour is the speed with which a gas-fire burns up when first lit. This is only an excuse in houses which have not electricity. The only other excuse being for places where it is impracticable to build a chimney for a coal fire and electricity is not laid on.

What this balderdash is intended to convey, we do not know. Perhaps the "Methodist Times" will explain. A gas-fire requires a chimney or flue the same as a coal fire, except that it need not be so capacious. An electric fire can be used without one, at the expense of the health of the occupants of the room, for there is nothing like a flue in a room for the maintenance of a healthy state of the atmosphere. Electric heating without a flue means air stagnation and pollution by human exhalation. The unintelligent would suppose from the absurd "Prize Entry" that it only requires electricity to be laid on to make it the most acceptable agent for heating. While, however, "E. Wells" gives some crude information as to the relative costs of coal and gas for heating, he says nothing about the appalling costs of electric heating for giving equal service. In regard to costs for coal and gas heating, the bare statement that the "prize entry" makes is ridiculous through its omissions. He says that a pamphlet issued by H.M. Stationery Office states the experiments proved that "gas was 2½ times dearer than coal; for while coal costs 3·7d. per hour, gas costs 8·7d. per hour." This is about as funny a statement concerning gas as we have ever come across. The 8·7d. will purchase a therm in gas in many districts, which would mean that the fire would have to be one which would consume no less than (with 500 B.Th.U. gas) 200 c.ft. per hour! With an efficiency of 75 p.ct., the heat given out to the room would be 75,000 B.Th.U. per hour! If anyone has seen anything regarding gas to beat that "Prize Entry" statement in downrightfalsehood, then we should like to hear of it. We should be interested to know the price per ton of coal and the price per therm or per 1000 c.ft. for the gas on which the costs are based; it would be instructive, too, to have the respective amounts of heat the coal and the gas give out to the room. In the next paragraph "E. Wells" says "a coal dealer estimates that a coal fire costs 2s. per week, while the gas company say that a similar gas-fire costs 6s. 6d. per week." Applying the 3·7d. per hour for coal and the 8·7d. for gas, the coal-heated "week" would be less than seven hours and the gas-heated "week" about nine hours! The Editor of the "Methodist Times" should look critically into this foolery that has been palmed-off as a "prize entry" and published by him. In considering relative prices, it must not be overlooked that during the day a coal fire is maintained continuously, and involves a lot of domestic labour; a gas-fire is lighted and extinguished as required, and involves no other labour. Thus gas fuel is saved when heat is not required; and it is the cheapest labour-saving heating agent available. To obtain 1 therm with electricity, 29 units have to be purchased; and so it is the dearest heating agent on the market.

On the point of relative heating effects, those versed in the science of heating will be amused by this gem:

> The heat from a gas-fire does not come within 100° Fahr. of that produced by a coal fire. The heat from a coal fire is radiant heat—that is, moves round obstacles easier than that from a gas-fire, which remains within the vicinity of the stove.

What size of gas-fire is it that does not give heat within 100° Fahr. of that produced by a coal fire (size also unknown)? Seeing that about 50 p.ct. of the heat from a gas-fire is of the radiant variety, and 25 p.ct. convected, we are at a loss to know why the heat should unkindly remain in "the vicinity of the stove." The explanation of "radiant heat" is the queerest we have ever seen.

The "Prize Entry" deals with coal and gas fires in relation to health; and here we have a perfect tissue of untruths. It is stated that the gas-fire "vitiates" the air of a room; "many medical men agree that the bad air caused by a gas-fire often causes bronchial trouble by affecting the throat; they also agree that a gas-fire in a bedroom is as dangerous as bad water." These and other statements we will summarily deal with by describing them as falsehoods.

If the Editor of the "Methodist Times" is not competent to judge between what is scientifically true and what is false, he had better, in the interests of his paper, refrain from publishing such matter until he submits it to someone who is qualified to pronounce an opinion upon it. Meantime, if he is conscientious, and desires to do the right thing, he will give as much prominence to this protest, or some other correcting article, as he has given to the fabrications of "E. Wells."

FINE GRINDING.

Parts IX., X., and XI. of Dr. Geoffrey Martin's report on "Researches on the Theory of Fine Grinding" formed part of the programme of the April meeting of the Ceramic Society at Stoke-on-Trent. Part IX. was concerned with connection between diameter and volume of irregularly shaped particles of crushed sand; Part X. with connection between diameter and surface of such particles; and Part XI. with calculations relating to diameters, surfaces, and weights of homogeneous grades of crushed quartz.

Details are very numerous; and in order to keep within moderate limits, it is proposed to omit the details, and confine this abstract to a statement of the more important results, with data which may have practical applications. In this way the three parts may be conveniently considered together.

In the case of particles of regular shape, the volume or surface is the product respectively of the cube of a length d (which is the diameter or some other definite line) and some constant number.

Thus in spherical particles $v = \frac{3{\cdot}1416d^3}{6} = 0{\cdot}5236d^3$

Also " " " $S = 3{\cdot}1416d^2$

" cubical " $S = 6d^2$

" " " $V = B.D^3 = B\,(1{\cdot}122d)^3$

Or . . . . . $B = d^3/(1{\cdot}122)^3d^3 = 0{\cdot}7082.$

(It was shown in Part IV. that the statistical diameter D of a cube of side d is $1{\cdot}122d$.)

In general, in particles of regular shape, $v = B.d^3$, and $S = A.d^2$.

The important results are brought out from the experimental determinations, that in particles of irregular shape, whether large or small, if d be the statistical diameter and v and S the corresponding statistical volume and surface respectively, then $v = B \times d^3$ and $S = A \times d^2$; the constants A and B respectively having the same value for the different sizes of particles. It thus appears that for irregular shaped particles, the same general relations exist between diameter, volume, and surface as for regular shaped particles. But it should be clearly understood that this only applies when the statistical diameter and corresponding volume and surface are taken of *homogeneous grades* of irregular particles.

A *homogeneous grade* is a collection of particles obtained by repeated air elutriation (of fine particles) or repeated sieving (of coarser particles) until the distribution of particles is no longer altered. The statistical diameter is the length of a line which seems to divide a particle (viewed under a microscope) into two equal portions, and d is the average value of a large number of such measurements.

As the value of the volume constant B was found to be the same (0·28) over a wide range of particles of crushed sand, it follows that the average shape of sand particles remains the same for the various sizes, thus refuting the contention of many practical men that the average shape of the particles alters as the fineness of grain increases.

Taking into account the difficulty of the determinations, the values obtained for the surface constant B are sufficiently close (2 to 2·49) to justify the same conclusion.

Twenty different homogeneous grades of sand of widely vary-

ing diameters were separated and their chief constants determined, as shown in the following table:

Constants of Different Homogeneous Grades of Crushed Quartz Sand Separated by Air Elutriation.

Sample.	Arithmetical Mean Diameter *d*. Cm.	Volume Constant B.	No. of Particles in 1 Gramme of Sample N.	Absolute Surface of 1 Gramme S. Sq. Cm.	Absolute Surface of 1 Lb. S. Sq. Ft.	Surface Constant A.
1 A	0·00333	0·23	31,426,800	791	386	2·14
1	0·00401	0·28	16,705,650	584	285	2·01
2	0·00459	0·28	11,296,900	508	248	1·98
3	0·00513	0·28	8,486,100	496	242	2·10
4	0·00551	0·28	8,181,850	443	216	1·95
5	0·00593	0·28	5,676,650	414	202	1·98
6	0 00673	0·28	3,846,150	367	179	2·01
7	0·00753	0·28	2,779,800	334	163	2 03
8	0·00895	0·28	1,650,000	315	154	2·27
9	0·00928	0·28	1,469,300	292	142 5	2·20
10	0·01089	0·28	889,050	244	119·1	2·21
11	0·01305	0·28	522,300	221	107·9	2·35
12	0·01551	0·28	323,300	187	91·3	2·29
13	0·01803	0·28	202,900	162	79·1	2·35
14	0·02172	0·275	116,520	141	68 8	2·44
15	0·02587	0·283	68,120	118	57·6	2·48
16	0·02957	0·273	47,200	107	52·2	2·49
17	0·04853	0·271	8,788	68·16	33·3	2·49
18	0·06277	0·306	4,712	52·70	25·7	2·49
19	0·08325	0·284	2,188	39·73	19·4	2·49
Standard Leighton Buzzard sand—						
(A)	0·09237	0·380	1,240	49·75	24·29	4·69
(B)	0·084	..	1,667	..	..	..

The sand was very pure, the percentage of silica ranging between 99·84 and 99·90. Specific gravity may be taken as 2·65, the determined values varying from 2·649 to 2·658, in most cases approaching the lower limit. For the volume constant B the value 0·28 may be used for calculations.

The values of *d* (in second column) may also be expressed by multiplying each by 1000, the number thus obtained having $\times 10^{-3}$ placed immediately after it giving $3{\cdot}33 \times 10^{-3}$, $4{\cdot}01 \times 10^{-3}$, &c. [$\times 10^{-3}$ is equivalent to $\div 10^{3}$ or 1000.]

The surface and volume constants enable calculations to be made of the surface volume and weight appertaining to any homogeneous grade of crushed quartz sand. The principal formulæ are:

(1) $v = B.d^3$, where v = average volume of one particle of statistical diameter d.
(2) $V = N \times B \times d^3$, where V = volume of N particles of same diameter d.
(3) $w = s \times B \times d^3$, where w = statistical weight of a single particle of specific gravity s.
(4) $W = N.s.B.d^3$, where W = weight of N particles of same diameter d.
(5) $N = W/(s \times B \times d^3)$, from (4).
(6) $S = N \times A \times d^2$, where S is the surface of N particles.
(7) $S = W/(s \times B \times d^3) \times A \times d^2 = W \times \frac{A}{B} \times \frac{1}{s} \times \frac{1}{d}$, substituting the value of N from (5).

All these formulæ appertain to homogeneous grades—*i.e.*, grades in which all the particles possess the same statistical diameter.

Any system of units may be used in the above formulæ if used consistently; but it is generally safer to employ the C.G.S. system (centimetres for length, grammes for weight, and seconds for time).

Two examples of calculation are given:

Example 1.—How many sq. ft. of surface are exposed by 1 lb. of crushed quartz sand, whose particles are all of average diameter $3{\cdot}5 \times 10^{-3}$ in.?
Diameter $d = 3{\cdot}5 \times 10^{-3}$ in. $= 3{\cdot}5 \times 2{\cdot}54 \times 10^{-3}$ cm. $= 8{\cdot}89 \times 10^{-3}$ cm.
This nearly corresponds to sample 8 in the table, with volume constant 0·28 and surface constant 2·27. Specific gravity = 2·65, and W = 1 lb. = 453·6 grammes. Substituting in (7) $S = W \times A/(B.s.d.) = 453{\cdot}6 \times 2{\cdot}27/(0{\cdot}28 \times 2{\cdot}65 \times 0{\cdot}000889) = 168{\cdot}0$ sq. ft.

Example 2.—What is the average weight of a particle of crushed quartz sand of $11{\cdot}81 \times 10^{-3}$ in. diameter, and how many go to the pound?
Weight of one particle is {from (3)} $w = s \times B \times d^3$.
$d = 11{\cdot}81 \times 10^{-3}$ in. $= 11{\cdot}81 \times 2{\cdot}54 \times 10^{-3}$ cm. $= 0{\cdot}03$ cm.
$w = 2{\cdot}65 \times 0{\cdot}28 \times (0{\cdot}03)^3 = 0{\cdot}000020034$ gramme.
And in 1 lb. or 453·6 grammes there are $453{\cdot}6/0{\cdot}000020034$ or 22,611,560 particles.

LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.

Annual General Meeting.

The Annual General Meeting of the Association was held at the Westminster Technical Institute on Friday, May 4, under the presidency of Mr. Leonard Lacey, B.Sc., Assoc.M.Inst.C.E.

The minutes of the last annual general meeting, which took place on May 6, 1927, were read and confirmed, and the Hon. Treasurer (Mr. H. F. G. Soar) submitted the financial statement. The balance-sheet was adopted on the proposition of Mr. W. E. Brown, seconded by Mr. W. H. Cosh.

Mr. Lacey's Report on the Session's Work.

Mr. Lacey then reported on the work of the Association during the session. He mentioned that the membership was the highest on record, being 334, compared with 313 in 1927 and 310 in 1926. It was a gratifying feature that such an increase in membership had followed the tightening-up of the rules of the Association. If they were to judge from the excellent attendances at their meetings, the programme for the session had been appreciated; and the Association were grateful to the authors of the papers, and to the various engineers of works who had been responsible for the arrangements for visits. It would have been noticed that, in connection with the Education Scheme of The Institution of Gas Engineers, District Committees had been formed; and four members of their Council had served on the District Committee during the session. Mr. W. T. Kenshole, the Senior Vice-President, had acted as Hon. Secretary; and the best thanks of the Association were due to him for his work. It would be impossible for him to continue his duties in this respect next session, as he would be occupying the Chair of the Association; but Mr. T. H. Prater, who would be the Junior Vice-President, had expressed his willingness to carry out the work. Mr. Lacey concluded his remarks by thanking the Hon. Secretary, the Assistant Hon. Secretary, the Hon. Treasurer, and the members of the Council for their support during his year of office.

Mr. P. F. Scarth proposed, and Mr. E. H. Hart seconded, the adoption of the President's report.

A vote of thanks to the Officers and Council for their work during the 1927-28 session was carried on the proposition of Mr. A. D. Bellingham, seconded by Mr. H. J. Risby. The Assistant Hon. Secretary (Mr. T. D. McSweeney) briefly replied.

Testimonial to the President.

Mr. Arthur Broadbent then proposed that a testimonial, in the form of an engraved salver, should be presented to Mr. Leonard Lacey—this proposition being seconded by Mr. F. S. Larkin.

Officers for the 1928-29 Session.

Following the reply of the President, announcement was made of the results of the election of officers for the 1928-29 session. These are as follows:

President.—Mr. W. T. Kenshole, Lea Bridge District Gas Company.
Senior Vice-President.—Mr. F. S. Larkin, Gas Light and Coke Company.
Junior Vice-President.—Mr. T. H. Prater, Isle of Thanet Gas Light and Coke Company.
Hon. Secretary.—Mr. Arthur Tennant, Croydon Gas Company.
Assistant Hon. Secretary.—Mr. T. D. McSweeney, South Metropolitan Gas Company.
Hon. Treasurer.—Mr. H. F. G. Soar, Gas Light and Coke Company.
Hon. Auditor.—Mr. E. C. Merry, Gas Light and Coke Company.

Mr. Prater proposed, and Mr. G. Winslow seconded, that a letter be sent to Mr. J. Stuart Kerr, the Principal of the Westminster Technical Institute, thanking him for the facilities offered to the Association.

Big Exhibition Buildings for London.

The Underground Railway Company have decided to revive the spacious grounds of Earls Court as an exhibition centre, and, with this object, to erect thereon some of the largest and finest exhibition buildings in the world. It is considered that Earls Court has no rival in or about London for this purpose. Experience gained at Wembley has brought about a change of opinion as to the desirability of big exhibitions being organized in a more accessible situation. Even Olympia has the drawback that, in order to reach it by the Underground Railway, it is necessary to change trains at Earls Court. The gas industry is no stranger to Earls Court. Its last great display there was in 1904; and if the proposed revival scheme is consummated (as Lord Ashfield, Chairman of the Underground Railway Company, has given his assurance it will be), the gas industry is sure to renew its old associations with what was in years gone by a very popular resort.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

ANNUAL GENERAL MEETING.

The Annual General Meeting of the Association was held at the County Hotel, Newcastle-on-Tyne, on Friday, May 4—Mr. T. P. RIDLEY (Newcastle), the retiring President, in the chair.

The PRESIDENT, before proceeding with the ordinary business of the meeting, referred to the deaths of two members since the last meeting—Mr. A. C. Fawcett, of Blyth, and Mr. Aaron Bell, of Morpeth. Mr. Fawcett was a quiet, unobtrusive, but very capable man, and a useful servant of the Blyth Gas Company. Mr. Bell was with the Newcastle Gas Company 35 years ago as a plumber. Later he went to Morpeth as foreman plumber, and finally was Distribution Superintendent. Letters of sympathy had been sent to the relatives by the Secretary; but he asked the members to record a vote of condolence at that meeting.

This was done, the members standing in silence.

INSTITUTION BENEVOLENT FUND.

On the motion of the PRESIDENT, seconded by Mr. BAGSHAW, it was agreed to confirm the recommendation of the Committee that a donation of ten guineas be made to the Benevolent Fund of The Institution of Gas Engineers.

WEYMAN MEMORIAL FUND.

The PRESIDENT, in accordance with a recommendation of the Committee, moved that a donation of ten guineas be made to the Weyman Memorial Fund. They would, he said, all have received circulars from representative men in the chemical and gas industries in relation to this matter; and the Committee desired that the subscription from the Association should not have anything to do with members' individual subscriptions. Dr. Weyman was a prominent member of the Association, and did great work in Newcastle for the whole of the gas and chemical industries; and the Committee thought it would be only right and fitting that the Association should make a subscription to the memorial fund.

Mr. J. E. BLUNDELL (Carlisle) seconded.

Major F. J. BYWATER (Newcastle) moved, and Mr. F. P. TARRATT (Newcastle) seconded, that the contribution from the Association should be 25 guineas.

The amendment was carried.

NEW MEMBERS.

Mr. L. M. Weldon, Distribution Superintendent, Hartlepool Gas and Water Company, transferred to membership.

Mr. J. Bonas, Middlesbrough.

INSTITUTION COUNCIL.

The PRESIDENT announced that Mr. F. P. Tarratt had been nominated for the Council of The Institution of Gas Engineers; and he asked the members to support Mr. Tarratt when the time for election came.

EDUCATION SCHEME.

Mr. C. DRU DRURY (Sunderland), Chairman of the District Education Committee, said that preliminary arrangements had been made for holding classes at Rutherford College, Newcastle, in Gas Engineering, Gas Supply Practice, and Gasfitting. As teachers, the services of Dr. Davidson had been secured for Gas Engineering, Mr. Craggs for Gas Supply Practice, and Mr. W. Batt for Gasfitting. Mr. Drury explained the scope of the classes and the necessary qualifications for the various grades, and appealed to the seniors to make it as easy as possible for their juniors to attend the classes. Undertakings were also asked to assist students financially by way of re-imbursing class fees, allowing travelling expenses when a student had to attend classes out of the town he resided in, leave from work when necessary, and also by the provision of copies of the technical papers in the office. At present the Newcastle classes were the only ones that were available for the district; but it was hoped to be able to establish some at Sunderland, when the number of applications from students increased.

The PRESIDENT expressed thanks to Mr. Drury, and said it was a scheme they ought all to endeavour to support, because it would be of the utmost importance in the future. Mr. Drury was Chairman of the Local Committee, and was the Association's representative on the Central Committee. They had a good Committee; and Mr. H. D. Lees (Hexham) had consented to act as Secretary. Applications and communications should be addressed to Mr. Lees.

PAPERS READ.

The following papers were then read and discussed: "Recovery Methods and the Ammonia Problem," by Mr. L. H. Sensicle, B.Sc., F.I.C., of Newcastle (see p. 384); and "Notes on the Design, Maintenance, and Working of Coal and Coke Handling Plants," by Mr. W. L. Robertshaw, of Sunderland. The latter paper is unavoidably held over.

On the motion of Dr. DAVIDSON, seconded by Mr. TARRATT, a hearty vote of thanks was accorded Mr. Sensicle and Mr. Robertshaw for their papers.

ELECTION OF OFFICERS.

President.—Mr. Dugald Currie (South Shields).

Vice-President.—Mr. C. F. Blincoe, Middlesbrough.

Committee.—Messrs. C. F. Barrow (Sunderland), J. R. Bradshaw (Hartlepool), and Dr. W. B. Davidson (Newcastle).

Hon. Secretary and Treasurer.—Mr. Norman S. Cox (Sunderland).

Auditor.—Mr. C. H. Armstrong (Newcastle).

THE PRESIDENT.

Mr. Dugald Currie, the new President, is a native of Campbeltown, Argyleshire, and served his indentures with Messrs. Hanna, Donald, & Wilson, of Paisley. Subsequent official appointments held by him include the Stirling Gas and Light Company, Belfast Corporation Gas Department, Airdrie Corporation Gas Department, and Nelson gas undertaking; while for nine years he has been Engineer and Manager of the South Shields Gas Company.

Mr. RIDLEY congratulated Mr. Currie on his election, and expressed the hope that he would have a happy term of office.

Mr. CURRIE, returning thanks, said he appreciated the honour very much. He recognized that he had a difficult job to follow Mr. Ridley; but he would do his best.

NEXT MEETING.

It was agreed to accept the invitation of the new President to hold the next meeting of the Association in South Shields.

A PRESENTATION.

Mr. CURRIE presented the retiring President with the Association's Certificate, and said that in Mr. Ridley they had had an admirable President, who had carried out the duties with distinction and marked ability. He conveyed to Mr. Ridley the warmest appreciation of the members for the many services he had rendered the Association. It was the wish of all that, though he was vacating the chair, he should continue to take an interest in the affairs of the Association.

Mr. RIDLEY thanked the members for the presentation, and assured them that he would have the interests of the Association as much at heart in the future as he had had in the past.

On the motion of Mr. S. SHADBOLT, seconded by Mr. H. D. LEES, a hearty vote of thanks was accorded the President, Committee, and Auditor.

The PRESIDENT briefly replied, and proposed a hearty vote of thanks to Mr. Norman S. Cox for his services as Secretary and Treasurer, which was carried with acclamation.

Coke Oven Gas for Fertilizer Production.

We understand that capital for an important new German synthetic nitrate enterprise, which will utilize coke oven gas for the manufacture of a wide range of fertilizers, is to be raised almost immediately in New York under the auspices of Dillon Read & Company, American bankers. The new Company, which is called the Ruhr Chemical Products Corporation, has been formed by a consortium of 27 of the leading coal and coke companies of the Ruhr, headed by the Vereinigte Stahlwerke A.G. (United Steel Works Corporation); and large plants capable of an annual production of 300,000 tons of synthetic nitrate, compared with a total world production of 695,000 tons, are at present in course of construction. The principal plant at Holton near the Rhine will, it is understood, be in operation early next year; and nine months later a second unit is to be started, to be followed later by several others. The processes used will be the Concordia-Linde and the Casale, for the production respectively of hydrogen and synthetic ammonia. These processes are stated to be a formidable rival of the Haber-Bosch process used by the I.G. Farbenindustrie. The present surplus of coke oven gas in the Ruhr is estimated at over 9000 million cub. metres annually, which, if fully utilized, is equivalent to an annual production of 1,800,000 tons of synthetic nitrate—*i.e.*, three times Germany's present output. Other important coke oven gas derivatives include a methyl petrol substitute; and it is intended to produce this on a large scale. The principal output of the new combine will be a range of fertilizers similar to the Nitrophoska fertilizers of the I.G. Farbenindustrie, and the possibility exists of a price-cutting war between the two great groups. Marketing of the new fertilizers of the Ruhr Chemical Products Corporation, however, will be through the Synthetic Nitrate Syndicate, the Corporation which markets for the I.G. Farbenindustrie; and this is regarded as indicative of an attitude of co-operation rather than competition between the two combines.

RECOVERY METHODS AND THE AMMONIA PROBLEM.

By L. H. Sensicle, B.Sc., F.I.C.

[A Paper before the North of England Gas Managers' Association, Newcastle-on-Tyne, May 4, 1928.]

The recovery of ammonia in the carbonizing industries has in recent years steadily receded from the position of being a ready source of substantial extra revenue until it now presents a double-sided problem for solution in the near future. The competition of synthetic ammonia has brought about the necessity for cheapening recovery or sacrificing most of the original profit accruing from the working-up of ammonia, while growing official objection to the pollution of rivers has created an additional imminent problem as to the manner in which the varying quantities of resulting effluent shall be disposed of, or rendered innocuous. The solution of the latter problem appears likely, in any case, to add to the costs already involved, and unless both problems are solved in an economically satisfactory manner, the recovery of ammonia bids fair to become in many cases an unprofitable necessity.

It seems possible that those small works which have been in the habit of disposing of their ammoniacal liquor for working-up elsewhere may be faced with an actual loss on their ammonia recovery. With regard to such transactions, P. Parrish has given details estimated for the pre-war period, and additional figures relating to 1924 conditions. In the former case sulphate of ammonia ("good grey 24 p.ct. NH_3") was taken as selling at £13 6s. 8d. per ton; the sulphate maker was represented as purchasing 10-oz. (2·17 p.ct. NH_3) liquor at 9s. 5d. per ton. In a balance-sheet including cost of manufacture at £4 per ton of sulphate, and items for railway carriage, tank hire, and cost of liquor, a profit of 19s. 8d. was shown per ton of sulphate made. His further figures for 1924 are illuminating. In a calculated sliding-scale with sulphate selling at £13 per ton, he gives the selling price of 10-oz. liquor at that time as only 2s. 4½d. per ton. At the present time sulphate of ammonia is only worth £10 per ton, and further falls in price are predicted, so that it appears that the sale and transport of crude ammoniacal liquor may soon become unprofitable to its producers.

At a recent meeting of the Central Executive Board of the National Gas Council, the desirability of cheapening the method of recovery of sulphate of ammonia was considered, and referred to the Effluents Committee of the Institution of Gas Engineers for report. At the meeting of the Institution on March 12, it was stated that "the Committee should hold a special meeting for the purpose of considering the proposal that the Institution should take up questions relating to the subject of sulphate of ammonia manufacture, in order that gas undertakings throughout the country might adopt measures that would ensure the profitable sale of sulphate."

Among the suggestions which have been advanced for reducing the effluent nuisance is the recommendation that "direct" recovery methods should be adopted at gas-works. The adoption of such recovery methods also has a direct bearing upon the cheapening of sulphate manufacture; and it seems fitting that the Effluents Committee will be able to investigate such methods exhaustively from both points of view. In the present paper an attempt will be made to examine some of the possibilities of direct recovery methods in relation to present problems, and to detail some results of working with such methods.

Historical.

The Inspectorate under the Alkali Act have for a long period favoured direct recovery processes, and have from time to time advocated their adoption by the gas industry. It appears that the gas industry made very early trials of such methods, but that those early experiences were in general so unfortunate that direct recovery fell into disrepute, and where adopted was eventually discontinued in favour of the resumption of the old and practically universal indirect method of extraction of the ammonia in the form of crude liquor and subsequent distillation. It was left to the bye-product coking industry to develop the direct and semi-direct processes until to-day they have reached a stage at which it can be safely said that both technical and economic advantages are shown on comparison with the indirect process.

The early failures in the gas industry can be attributed to several reasons, which may be fairly well estimated by perusal of the anunal reports of the Chief Alkali Inspector. In the 56th Report (1919) a list was given, covering the period 1910-20, of gas-works which had tried, or were still operating, the direct process. The number totalled only 25, and all were apparently small works, since the maximum annual make of sulphate of ammonia recorded was 99 tons, and the average for all the works was 25 tons per annum. The average yield of sulphate was only 17½ lbs. per ton of coal carbonized—strong evidence of the inefficiency of the plants in operation. With one exception the dates of installation of direct recovery plant were in the years 1910 to 1915, so that the efforts might almost be termed pioneering work. One of the most striking facts which emerge from the records of those gas-works trials is that the process used was not even what would now be classed as "semi-direct." In the 54th Report of the Chief Inspector (1917) it was stated that at one works it had been found that, of the ammonia leaving the retorts, 89 p.ct. was condensed with the virgin liquor, and only 11 p.ct. was left in the gas to pass on to the saturator, or "bubbler" as it was then called. This result was obtained in April, and the ammonia content of the gas entering the saturator was only 32 grains per 100 c.ft. In the following September, the figure had risen to 166 grains.

The saturator was evidently placed in a position nearly last in the scheme of recovery, and must have been near the purifiers. Very much was heard of disorganization of the purifiers at many of the works. The reason for this is now obvious. The above figures indicate that there was apparently no further gas cooling apparatus after the saturator, and a very variable condition of temperature and humidity would exist in the gas entering the purifiers. In one case it was stated that the temperature of the gas entering the purifiers had been 90° Fahr. The oxide had become sodden and acid in reaction. It also appears that at the small works where direct recovery was tried out purification technique had not reached a very advanced stage; it is also probable that sufficient technical supervision would not then be available effectively to regulate purification or to investigate thoroughly the conditions for successful operation of the ammonia recovery process. There was frequent reference to the suggested adoption of rotation methods of working the purifiers, changing to downward flow, better temperature control, &c. Loss of ammonia was frequently mentioned as occurring in the still effluent in the fixed form. In such cases it was pointed out that it had not been appreciated that the virgin liquor incidental to the process would contain considerably more fixed ammonia than an ordinary gas liquor, and that hence the stills were often being worked with insufficient liming.

The fundamental error in the direct recovery experiments was that the saturator was in the wrong position. It should have been working on hot gas at a point near the retort house. There should be no disorganization of purifiers resulting from the process, since it is essential to pass the gas through efficient coolers after the saturator. Unfortunately the misconceptions seemed to persist, and were apparently shared by the Chief Alkali Inspector. In 1919, when many works had abandoned the process, a statement in the 56th Report was as follows: "The conditions for efficiency are now better known. The acid washer is kept cooler; drier oxide is now charged in the purifiers; boxes, where exposed, have been protected from the weather, and their temperatures regulated by thermometric data systematically recorded; and, of late, further improvement has been effected at the best conducted works by the adoption of the 'backward system' of oxide purification with downward flow of gases. . . ."

In spite of the above optimistic statement, there is a tacit admission in the same report that the method of working had not turned out as well as had been expected. It is contained in the following, which will be quoted in concluding this brief record of the history of the process in the gas industry: "The direct and semi-direct processes in which the ammonia present in the gases generated from coal by destructive distillation is removed by the action of sulphuric acid continued to give satisfactory results in coke oven practice. In the conditions existing at gas-works, however, the experience was different. The problem of gas purification does not necessarily arise in coke-oven works, but, in the smaller gas-works especially, the additional and continuous care required by a process in operation at all times is less attractive than one in which gas liquor is distilled as occasion and convenience require, and one by which the efficiency of gas purification is less liable to be affected. There is therefore a tendency to revert to the older style of working."

A passing reference may be made to the question of purifier working in relation to the direct process. There is only one way in which the purifiers need be affected, and that is in respect of the extra sulphuretted hydrogen passed into them. In the indirect process it is well known that a certain amount of sulphuretted hydrogen is absorbed at the scrubbers. This has been stated to amount to 7 p.ct. of the total in the gas, but is sometimes more. The amount depends both on the total concentration in the gas and upon the strength of the liquor with which the gas comes into contact. The point is really immaterial, since any sulphuretted hydrogen absorbed by the liquor has subsequently to be removed from the saturator gases in the indirect process.

"Direct" Recovery Methods.

The principles involved are theoretically simple. The best position for the saturator is one where the gas is at a temperature several degrees above its dew-point. This enables the

saturator to be worked without accumulation of mother liquor. If installed at any other point in the gas stream where the gas is saturated with water vapour (as in semi-direct processes) it is necessary either (1) to reheat the gas slightly before it enters the saturator, or (2) to employ steam heating coils in the saturator itself. These precautions are necessary to avoid undue condensation, and in fact to ensure that a certain amount of evaporation is made to take place from the bath into the gas stream. The latter condition is necessary on account of the fact that a certain amount of water has unavoidably to be added to the system for washing-out centrifuges, spraying into the top of the saturator, adjusting the strength of the bath, &c. In all direct or semi-direct recovery systems the saturator is of necessity working at a temperature considerably above that of the building, and there is thus a continual loss of heat taking place. It is always advisable to lag the body of the saturator in order to reduce such loss to a minimum. The heat of reaction resulting from the absorption of the ammonia by the sulphuric acid contributes largely to the maintenance of the temperature required, but it is usually desirable in any circumstances to instal a heating coil so that heat can be supplied when necessary—*e.g.*, during low gas make periods, when starting up the plant, &c.

The moisture in the gas from the carbonizing plant is derived from three possible sources; (1) Water from the coal substance arising from the hydrogen and oxygen content of the coal and liberated on destructive distillation (this usually amounts to from 4 to 6 p.ct. of the weight of the coal, but may be more with highly oxygenated coals); (2) water attached to the coal which may be both moisture in the coal as mined and added water in the case of wet washed coals; (3) water evaporated from liquor in the hydraulic main, or from sprayed liquor in the "dry" main in modern coking practice. The following table gives approximate values for the dew-point of the gas, assuming certain definite quantities of water, expressed as percentages of the weight of coal charged. The figures are based on a yield of saturated gas at 15° C. and 760 mm. amounting to 13,000 c.ft. per ton of coal.

Water Carried, P.Ct. on Coal.	Dew-Point of Gas.		Vol. of Gas Relative to Vol. Dry at 0° C., 760 mm.
	°C.	° Fahr.	
4	51	123·8	1·36
5	55	131	1·42
6	58·5	137·3	1·48
7	61	141·8	1·54
8	63	145·4	1·59
9	65	149	1·64
10	67	152·6	1·70
11	68·5	155·3	1·75
12	70	158	1·81
13	71·3	160·4	1·87
14	72·3	162·2	1·92
15	73·2	164	1·96

The above table will be referred to in connection with the conditions necessary for the successful operation of direct recovery at gas-works.

The Semi-Direct Process.

This process involves the production of a certain amount of liquor caused by cooling the gas to about 45° C. (113° Fahr.). The gas passes through primary coolers and then via an exhauster to the tar extractor, which is usually of the semi-immersed slowly rotating perforated cylinder type. The gas at 45° C. is usually in a saturated condition, and is therefore in some modifications of the process reheated—sometimes by heat interchange with hot gas, or else by closed steam coils. When the gas is not reheated the saturator is furnished with adequate steam heating coils. The latter are often composed of a copper core and covered with lead. The gas bubbles from immersed lead "cracker" pipes or "curtain" pipes through a seal of hot acid mother liquor, and the ammonia is extracted. There is usually an acid spray trap situated above the saturator in the outlet gas stream. After the saturator the gas is passed through further cooling and naphthalene and benzole extracting plant.

The virgin liquor condensed has in the case of coke ovens working on washed coal containing about 8 p.ct. of adhering moisture a content of total ammonia amounting to about 0·9 p.ct. w/v. This liquor is stripped in a small continuous still adjacent to the saturator. The still is only operated for a day or two at intervals governed by the accumulation of the stock of liquor. The ammonia and steam vapours from the still, after passing through an efficient dephlegmator, are led into the main gas stream immediately before the saturator. The gas enters the saturator under a pressure of 20 to 30 in. W.G., and the seal of acid liquor is kept adjusted to throw a back-pressure of about 10 in. W.G.

The Direct Process.

The hot foul gas is not allowed to cool below 80° C. (176° Fahr.) in the case of oven plants working on wet washed coal. The reason for this will be obvious if the calculated dew-point table given above be examined. In the process all the ammonia except that existing in the fixed state in the gas at this stage—practically entirely ammonium chloride—is extracted *in toto* by the saturator, and no auxiliary still is required. The ammonium chloride dissolves in the hot liquor sprayed into the gas at the tar extraction points preceding the exhauster and saturator. This liquor is constantly recirculated until the content of ammonium chloride reaches about 20 p.ct. and is withdrawn from circuit. A certain amount of evaporation takes place into the gas, and is periodically made good by addition of water. Two systems of direct recovery will be described.

(1) *The Otto Direct Recovery Process.*

The hot gas is cooled to a temperature several degrees above its dew-point, and passed into the tar extractor. This consists of a chamber into which the gas emerges through a narrow neck together with a large volume of tar and liquor pumped and sprayed in under high pressure. The gas, freed from tar fog, passes through the exhauster, which forces it under the necessary pressure through the seal of hot acid mother liquor in the saturator, and the ammonia is extracted. The naphthalene extraction tower follows, and here the gas is cooled suddenly by powerful jets of water sprayed from the top. The naphthalene is precipitated together with accompanying light oils, and collects at the base of the tower. It is filtered from the water and is recovered as a yellowish granular paste. Further cooling of the gas is practised prior to the benzole scrubbers.

(2) *The Simon-Carves Direct Recovery Process.*

The hot foul gas enters an atmospheric cooler where the temperature is lowered to 95° C. (203° Fahr.), and thence passes to a cyclone tar extractor of the Colman type (fig. 1).

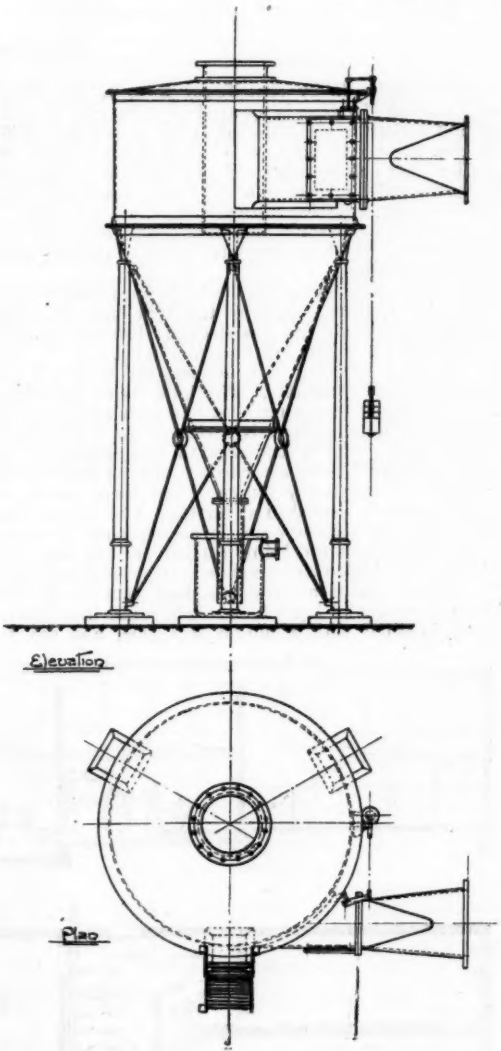


Fig. 1.—Cyclone Tar Extractor.

This consists of an inverted cone at the wide end of which the gas enters tangentially. Here part of the tar fog is removed owing to the swirling motion imparted to the gas and impingement of the particles on the outer walls. From this extractor the gas passes into a centrifugal extractor rotating at 350 R.P.M. (fig. 2). This machine is similar in type to a high-speed exhauster; the gas being drawn in at the centre

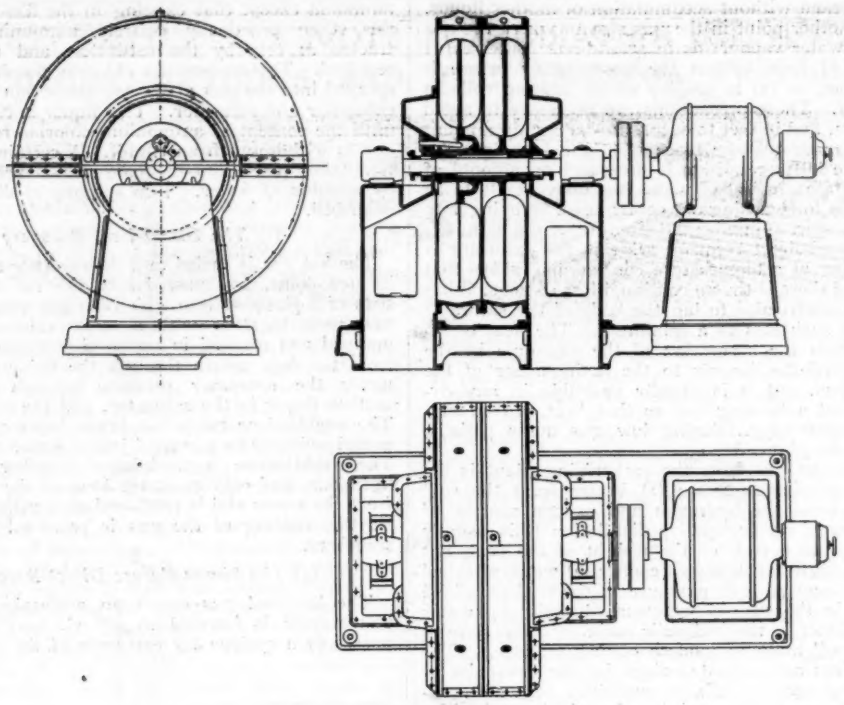


FIG. 2.—ROTARY TAR EXTRACTOR.

and thrown outwards by centrifugal force to the periphery. Warm "chloride" liquor is sprayed into the gas stream as it enters, and assists in the removal of the remainder of the tar fog at this point. It may be mentioned that liquor is also sprayed into the before-mentioned atmospheric cooler, into the cyclone extractor, and also into the main at suitable points in the short lengths occurring between those units of plant. The object of this is to dissolve ammonium chloride, and to wash it out of the tar, which is otherwise liable to thicken and form troublesome deposits.

It is obvious that, owing to the high temperature at which the tar fog is separated, much of the light oils, tar acids, and naphthalene pass on in the gas stream. Results of investigations on the latter point will be given later.

The saturator, working at a temperature of 80° C., immediately follows the exhauster. The latter is of the high-speed type and rotates at 3000 R.P.M. It has been suggested that in direct recovery systems there is a risk of tar fog persisting in the cooled gas. This is contrary to experience. It is true that oils and naphthalene are carried forward past the tar extractor and are eventually removed, but these are in vapour form and cannot be described as tar fog. The only condensates obtained after the saturator are invariably pale in colour, and show no evidence of tar being carried on. It may be mentioned that the high-speed exhauster superimposed upon the tar extraction system already described acts as an excellent final trap for traces of fog which might reach that point. The exhauster is fitted with a run-off seal pipe, and any tar collected can drain away. It is true that a certain amount of black tarry matter separates from the mother liquor leaving the saturator, and is periodically skimmed off with ease. It is possible that this is not derived from actual tar fog in the gas, but results from the action of the hot acid bath upon organic constituents in the gas.

After extraction of the ammonia at the saturator, the gas passes to a serpentine cooler, where the temperature is reduced to about 38° C. (100·4° Fahr.). Final cooling to about 20° C. is effected in multitubular coolers set vertically. The principle of the working of these is similar to that suggested by Dr. Carpenter. Water circulates inside the tubes while the gas passes round them and meets a spray of tar or creosote oil which removes most of the remaining naphthalene.

Fig. 3 is a plan of the lay-out of plant to deal with 10 million c.ft. of gas per day. There are three each of rotary tar extractors, exhausters, and saturators. Two streams of 5 million c.ft. per day pass through two sets of apparatus; there being always one of each in reserve for contingencies.

Some Experiences with Direct Recovery.

In experience with both the semi-direct and the direct processes of ammonia recovery it has been found that with adequate supervision the work can be carried on uninterruptedly over a period of years without appreciable loss of ammonia. The provision of a spare saturator is a necessary precaution and avoids temporary loss and disorganization which might occur at fairly wide intervals.

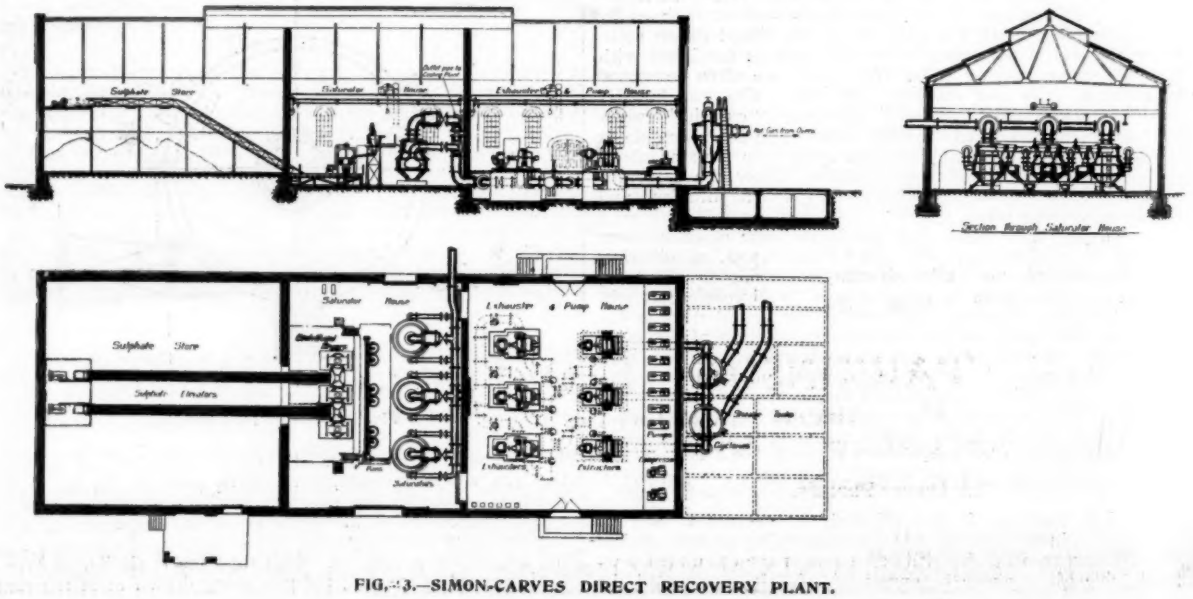


FIG. 3.—SIMON-CARVES DIRECT RECOVERY PLANT.

Fig. 4 shows the salient features of the internal structure of the saturator in the last process described. The "curtain" or "cracker" pipes shown have the section of an inverted U, and are about 9 in. wide. They are made of heavy lead, and have deep serrations along their base. These are about 1 in. wide and 6 in. deep. There are two curtain pipes, each curved round the saturator in semi-circular formation. An entering gas main is connected to the mid-point of each—*i.e.*, on opposite sides of the saturator. The successful working of the plant depends upon adequate turbulent circulation of the acid liquor so as to obtain a continual wash over the tops of the curtain pipes and to prevent the building-up of sulphate deposits there. The acid liquor return pipe has also to be carefully adjusted to ensure that the return flow enters the active zone of turbulence. If this is not done, the liquor washing over the curtain pipes through which the gas is bubbling soon becomes denuded of free acid; and loss of ammonia results. Deepening of the serrations in the curtain pipes and adjustment of the direction of delivery of the liquor return pipe have both been found necessary and have effectively cured erratic working of such a saturator experienced at the outset of its working.

It will be observed that where the gas "lead-in" is connected to the curtain pipes, these rise towards the wall of the saturator. As a result there is not an adequate wash of liquor over these parts, and it has been found that a slow accumulation of salt grows there. This has necessitated changing over to another saturator every few months while the deposit was dissolved away by making up a deep dilute bath. However, arrangements to ensure that a water spray at the top of the saturator reached these parts of the curtain pipes eventually cured the trouble.

Water is sprayed from the top of the saturator at each "make-up" of the bath, and serves the dual purpose of washing away sulphate deposited from spray in the upper chamber and of adjusting the strength of the bath. In common with experience usual in working indirect saturators, it has been found impracticable to work a continuous salting process. The intermittent "make-up" system effects a clearing-away of any rock salt, which shows a tendency to grow in most saturators. In the system alluded to above, the practice has been to remake the bath about six or seven times a day; the frequency being regulated by the time taken to fill a conical copper pan with enough salt for three "whizzings" of 4 cwt. each. The saturator bath is made up to a sufficiently high Twaddell and acidity with mother liquor, acid, and water to allow the acidity at the end to be not appreciably below 4 p.ct. Circulation of the bath liquor is maintained continuously by means of a steam or compressed-air ejector. The conical pan is kept full of liquor, and the salt ejected sinks to the bottom. The main objection to the latter system is that the acidity of the sulphate from the three successive charges in the centrifuge is different. Thus each requires separate treatment in neutralization, and devices for continuous feed of neutralizing agent to the sulphate drier are rendered ineffective. The acidity of the salt after centrifuging is determined by the acidity of the liquor accompanying it when charged in the form of sludge. The following working results are of interest as illustrating the point.

Mother Liquor and Sulphate Tests (Direct Saturator).

		P.Ct.
8. 0 p.m.	Salt in pan 1 ft. 6 in. below surface— Liquor at this depth. Free acid	6·0
9. 0 p.m.	Commenced centrifuging— Circulating liquor, 58° Tw. Free acid . .	4·23
	Liquor from bottom of pan (first runnings from centrifuge). Free acid	9·84
	Salt whizzed without water wash. Free acid .	0·52
10. 0 a.m.	Bath made up just previously— Circulating liquor 63° Tw. Free acid . .	9·02
11.30 a.m.	Circulating liquor 60·5° Tw. Free acid . . .	6·35
11.40 a.m.	Liquor 18 in. below surface (top of salt in pan). Free acid	6·18
12.35 p.m.	Pan full of salt— Circulating liquor 57·5° Tw. Free acid . . .	4·48
	Liquor from bottom of pan (first runnings from centrifuge). Free acid	8·45
	Salt whizzed without washing. Free acid . .	0·33

Owing to separation of the tar fog at a high temperature, considerable amounts of pyridine bases escape absorption by the tar vesicles, and pass on to the saturator. Some pyridine is absorbed by the acid, and appears in the centrifuged sulphate. The following content was found for an average sample from a week's make of 30 tons:

Centrifuged Direct Recovery Sulphate of Ammonia.

Pyridine	0·277 p.ct.
Expressed as NH_3	0·06 p.ct.

The pyridine is very loosely combined, and is set free even by the addition of ammonia. On drying in a hot dryer the pyridine is liberated, and the possibility of recovering it by installing a water cooled condenser on the outlet vapour pipe from the dryer has been seriously considered. On neutralizing the sulphate any slight excess of alkali gives rise to a very pronounced yellow colouration. This is believed to be due to the formation of pyridine hydroferrocyanide. The colour is not destroyed on drying, but it becomes fainter.

The recovery of ammonia at the saturator has been mentioned as very satisfactory. Excluding the ammonia recovered in the "chloride" liquor, the yield per ton of coal averages 24 to 25 lbs. of sulphate—a figure which is well over that obtained from similar coals carbonized at gas-works. It is believed that the increased recovery is not wholly due to the method of carbonization, but that the use of direct recovery does ensure better ammonia recovery returns than the indirect process.

Continuous tests are run on the outlet gas from the saturators. Pyridine, being a weak base, is carried forward in greater quantity than ammonia, but both are usually determined to-

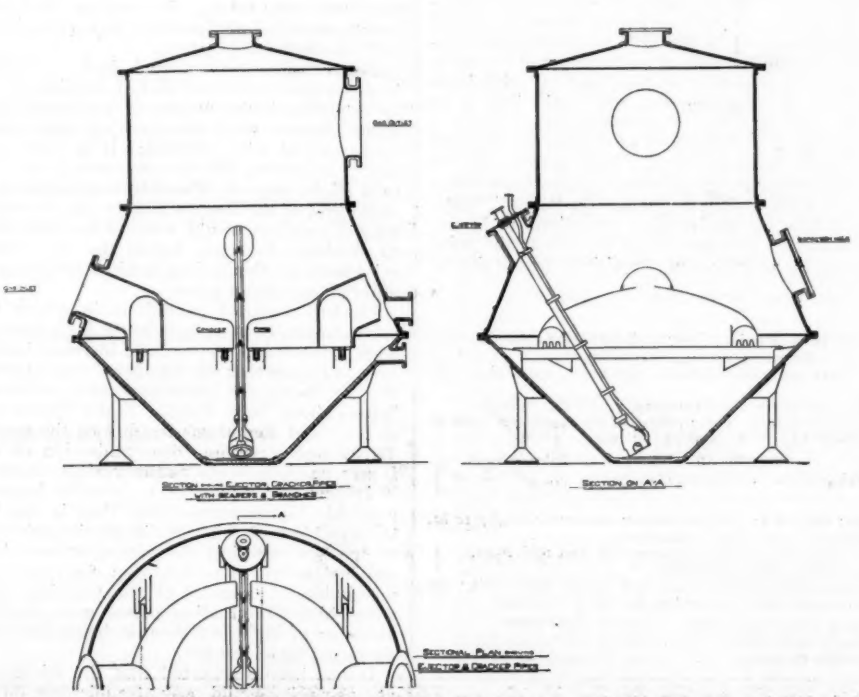


FIG. 4.—MAIN DETAILS OF THE SATURATOR.

gether as ammonia. The following were results obtained in normal working:

Gas Stream after Saturator. (*Temp.*, 75° C.)

—	Grains per 100 C.Ft.	Expressed as Lbs. S/A per 12,000 C.Ft.
Total pyridine and ammonia expressed as ammonia	5·28	0·362
Pyridine	12·82	..
Pyridine expressed as ammonia	2·76	0·190
Actual ammonia	2 52	0·172

The ammonia in the cooled gas (after benzole scrubbers) less than 0·5 grain per 100 c.ft.

The aqueous liquor condensed in the first cooler's serpentine after the saturator absorbs most of the pyridine and ammonia carried forward. The following results were obtained:

Free ammonia and pyridine expressed as ammonia	0·0162	p.ct. w/v
Fixed ammonia	0·0017	,, ,,
Total ammonia and pyridine expressed as ammonia	0·0179	,, ,,
Pyridine	0·0213	,, ,,
Pyridine expressed as ammonia	0·0046	,, ,,
Actual free ammonia	0·0116	,, ,,

The "chloride" liquor circulated in the tar extraction plant is allowed to absorb fixed ammonia until concentrated to a point safely below its crystallizing strength. A sample of a bulk of this liquor withdrawn from circulation gave the following analysis:

Specific gravity	0·083 at 70° Fahr. (*i.e.*, 16·6° Tw.)
Fixed ammonia	8·30 p.ct. w/v
Free ammonia	0·22 ,, ,,
Total ammonia	8·52 ,, ,,

Fixed ammonia expressed as ammonium chloride, 26·1 p.ct.

Possibilities of Direct Recovery at Gas-Works.

It has been shown that the successful working of direct and semi-direct processes of ammonia recovery is primarily dependent upon the study and control of the temperature and humidity conditions of the gas. Direct recovery must be worked on gas at a higher temperature than its dew-point. Semi-direct processes can be worked at a slightly later stage in the cooling of the gas. When possible it is more economical to instal the direct process; and at first glance it would seem that conditions at gas-works ought to be more favourable to its adoption than conditions at coke ovens. The latter usually carbonize washed coal containing perhaps 10 p.ct. of adhering moisture, which, together with (say) 5 p.ct. of water from the coal substance, amounts to 15 p.ct. by weight of the coal charged. Reference to the dew-point table given on a previous page will show that in such conditions the direct saturator would have to be worked at a temperature in the region of 80° C. (176° Fahr.) in order to be on the safe side of the dew-point. On the other hand, gas-works almost invariably use dry coal, and the gas from the retorts would thus carry, perhaps, water amounting to 5 p.ct. of the weight of the coal. The dew-point in these conditions would be 55° C. (131° Fahr.), so that a working temperature of 60° C. (140° Fahr.) should be high enough for operation of a direct recovery saturator in gas-works practice. There are two further points, however, which were not considered above: (1) In the case of continuous vertical retorts there is a certain amount of undecomposed steam in the gas derived from the steaming process, and (2) with horizontals the important effect of the hydraulic main has to be taken into account. The practice of bubbling the gas from a dip pipe in a seal of liquor has the effect of cooling the gas and of imparting additional moisture to it. This matter will be referred to later. Following are given some temperatures taken recently at three gas-works. These are mostly "spot" tests, but are useful as indicating the varying conditions to be expected; they will be further commented on later from the point of view of the possibility of obtaining conditions favourable to direct recovery.

Works A—

Horizontal retorts; beds of 10 in 5 tiers; 10-hour period; retorts, 22 in. by 18 in. by 22 ft. Ascension pipes, 7 in. in diameter.
Foul gas main: Three temperatures read—133° Fahr., 130° Fahr., 132° Fahr.
Liquor run off from tar tower: Temperature, 119° Fahr. (mean).
Top of dip-pipes of one retort: Temperature of the gas "spot" test at either end:

One end	252° Fahr.
Other end	132° ,,

Works B—

Horizontal retorts; beds of 8; 10-hour period; retorts, 22 in. by 16 in. by 20 ft. Ascension pipes, 6 in. in diameter.
Foul gas main: Temperature steady between 118° and 120° Fahr.
Liquor leaving hydraulic main, 104° Fahr.
One retort: Ascension pipe tested at one end of the retort only; the following temperatures were obtained at the top of the pipe:

Before charging retort (door open)	120° C. (248° Fahr.)
After charging (1 hour later)	250° C. (482° ,,)
Three hours after charging	190° C. (374° ,,)

Works C—

Continuous vertical retorts:

Collecting main, gas temperature	207° C. (404° Fahr.)
Inlet of first coolers	160° to 170° Fahr.

It will be seen that the temperature conditions at the vertical retort installation are satisfactory for the employment of direct recovery, for without any special precautions such as lagging of mains the temperature of the gas at the first cooling plant is over 160° Fahr.—*i.e.*, 20° above that suggested for the working of the saturator when dry coal is carbonized.

The case of horizontal retorts is interesting. One authority has stated that the temperature of the gas entering the hydraulic main is usually about 160° Fahr.—a temperature which seems too low for present purposes, when it is considered that further cooling takes place in the hydraulic main. In the above works the temperature of the mixed gas in the foul gas main immediately after the hydraulic main was about 130° Fahr. and 120° Fahr. respectively. These temperatures are to be expected when it is considered that the gas had bubbled through liquor in both cases, the corresponding temperatures of which were about 119° and 104° Fahr. respectively. The double disadvantage of wetting and cooling the gas unduly by passing through a seal of liquor has been referred to before. It would seem that, when desired, the difficulty can be readily overcome by adopting one of the anti-dip devices by means of which the equivalent of a dry main is secured. The anti-dip devices of Simmonds and Cort seem to be the kind of appliance desirable. In these the gas does not bubble through the liquor in the main, but passes over it. In the former type the gas issues from a slide valve on the side of the dip pipe and above the level of the liquor; in the latter a dipping sleeve pipe is raised to allow the gas to pass over the top of the liquor. In both cases sealing in the liquor is effected when the retort is opened, and the operation is controlled by a lever system worked from below. The Davidson anti-dip device is also possible of adaption to the purpose, but it has the disadvantage that the rising cone valve completely closes the dip pipe and allows of no safety release for the gas should the retort door be closed too soon.

Referring again to the temperature of the gas entering the hydraulic main, it is obvious that experience with horizontal retorts is likely to be very varied. The serried ranks of ascension pipes are in effect a most efficient, if somewhat uncontrollable, primary cooling unit. In the short distance from the retort mouthpiece to the dip pipe the gas falls hundreds of degrees in temperature. The actual temperature of the gas at different dip pipes is likely to show very large variations. The temperature of the gas from the top retorts in the bed will be higher, owing to the shorter ascension pipes. The temperature in any one pipe will vary according to the time which has elapsed from the charging of the retort, owing to changes in the rate of gas evolution. The temperatures will also vary in accordance with the incidence of draughts of cold or hot air striking the ascension pipes. In general practice there is an ascension pipe at both ends of the retort, but it appears that equalization of the amount of gas passed up them is of haphazard occurrence. The use of absolutely identical seals in the two dip pipes appears difficult of achievement; also, slight variations in the distribution of heat along the retort, and in the swelling of the charge will affect the path taken by the gas. In the "spot" tests quoted for one retort at works A it was obvious that "hunting" was taking place, and that most of the gas was passing up one of the pipes at the time the temperatures were taken. In the case cited for works B the temperatures found at the top of one ascension pipe were probably well above the average.

Full consideration of such factors as those discussed above leads to the conviction that, assuming dry main conditions to be established, the matter of obtaining a sufficiently high gas temperature from a bench of horizontal retorts would be quite easily settled when desired. It is only necessary to limit the extent of cooling which now takes place in the ascension pipes to a slight degree. Possibly lagging of a short length at the upper end of the longest pipes would be sufficient. In any case such a measure would seem to be desirable in any case, so as to eliminate in some degree the wide differences which now exist between the cooling, and probably tar refluxing, effects in different ascension pipes.

Having obtained conditions in which the gas leaving the retort house is at a sufficiently high temperature and has not been subjected to appreciable increase in humidity, it is necessary to ensure that the gas is conveyed to the saturator through the tar extraction apparatus and exhausters without falling below about 160° Fahr. Short distances of travel are desirable, and sometimes lagging of the main may be advisable. To overcome possible disorganization of temperatures arising from variations in the quantity of gas made at different periods, it is probably advisable to provide lagged mains or an appreciably higher temperature than is required, and to insert a by-passable cooler in the circuit, in order that the temperature of the gas entering the saturator may be controllable. The present lay-out of mains from the retort bench is likely to be unsuitable on account of the practice, dating from the time when high illuminating power was sought, of installing long stretches of main in the retort house and outside to bring about slow cooling of the gas.

It has been suggested that the adoption of direct recovery at gas-works would prove troublesome on account of the varying makes of gas from time to time. The suggestion has been that, during low makes of gas, sulphate tends to build-

up on the curtain pipes of the saturator. Such a possibility is admitted, and as has been previously mentioned would be due to insufficient over-wash of acid liquor caused by insufficient turbulence of gas flow. The implication is that the saturator for normal makes of gas would be too large for successful working on the reduced outputs. The difficulty could be overcome by installing an auxiliary saturator having (say) two-thirds the dimensions of the larger one, and changing over to this when the gas output is seriously curtailed. An alternative suggestion to overcome the difficulty has been made. This is to use a specially designed saturator. The curtain pipes in such a saturator are wider than usual and have a dividing plate traversing their length underneath in such a way that the volume on the outer side of the plate is appreciably greater than on the inner side. The inner and outer compartments are connected to separate "lead-in" mains. The inner face of the curtain pipe forms part of the circumference of a much smaller circle than the outer, and the number of serrations for gas bubbling is considerably less. The serrations are cut higher on the inner face. During low gas make periods gas is conducted to the inner compartments of the two curtain pipes. Owing to the higher serrations, the level of the acid liquor is raised, in order to throw the usual 10 in. W.G. back-pressure. The joint effect of these conditions is that the over-wash of liquor, which in this case takes place from the middle of the saturator outwards, is as effective in clearing the tops of the cracker pipes as would be the over-wash from the outer circumference to the middle of the saturator which would be obtainable with larger quantities of gas admitted only to the outer compartments of the curtain pipes.

From the point of view of ammonia recovery some of the advantages of direct recovery methods as contrasted with present methods may be mentioned. The fixation of the ammonia by sulphuric acid at the earliest possible moment secures an avoidance of those small but continuous losses common in the indirect method. Among these losses may be enumerated evaporation of ammonia into the air due to "breathing" of tanks, admixture of hot tar and liquor with cool strong liquor, exposure of overflow and sight feeds, irregularity of scrubber working owing to naphthalene blockages, &c. There is also the loss of ammonia in the effluent liquor from the stills to consider. At the stills alone 95 p.ct. recovery of the ammonia entering with the liquor is considered good practice, while 92½ p.ct. recovery is usually the working figure taken as a basis for sliding-scale calculations of the market value of crude liquor.

The main advantage of direct recovery, however, lies in the savings which can be effected in the first cost and running costs of the plant. It is sufficient to state that ammonia scrubbers, circulating pumps, liquor stills, and liming plant are eliminated, and that the labour required should be no greater than with indirect plant. The large steam requirements of the ammonia stills are eliminated, and this implies the setting free of boiler plant, fuel, and labour for other purposes.

P. Parrish (J.S.C.I. 1922, p. 232 T, fig. 3) gives a graph indicating the steam consumption per pound of NH_3 for liquors of various strengths distilled in a small experimental plant. For a liquor of strength 1·5 p.ct. (6·9 oz.) the steam consumption was 10 lbs. per lb. of ammonia. This represents a steam consumption of 15 p.ct. of the weight of the liquor distilled. Probably 20 p.ct. would be a common figure in works practice. To arrive at the steam cost, assume a works where 22 lbs. of sulphate per ton of coal are recovered—*i.e.*, where 101·8 tons of coal are carbonized per ton of sulphate made.

Liquor (1·5 p.ct. strength) made per ton of coal . .	367 lbs.
" " " per ton of sulphate .	37,320 lbs.
Steam required (at 20 p.ct. by weight of liquor) . . .	7,464 lbs.
i.e.,	3·33 tons per ton of sulphate
Cost of steam (3·33 tons at 3s.)	10s. per ton of sulphate

101·8 tons of coal yielding (say) 5 p.ct. of water on carbonization produce 11,397 lbs. of water.

Deducting this from the total weight of liquor made, the water consumed for scrubbing amounts to . .	2592 gallons
Add water for lime mixing at (say) 25 p.ct. of the total liquor.	933 gallons
Therefore total water consumption per ton of sulphate is.	3523 gallons
Cost of water at 6d. per 1000 gallons	1s. 9d. per ton of sulphate

Allowing 15 p.ct. of the ammonia in the liquor to be in the fixed form, and the lime consumption to be 0·5 times the weight of fixed ammonia:

Lime consumed per ton of sulphate is	0·0188 tons
Cost of lime at 25s. per ton	5½d.

Thus total cost of steam, water, and lime in the case under consideration is 12s. 2d. per ton of sulphate made.

Items such as cost of maintenance of scrubbers and stills, supervision and upkeep of circulation pumps, and interest and depreciation on cost of such plant have been omitted from the above cost ascertainment; but it seems safe to say that a saving of at least 10s. per ton of sulphate made should be shown in favour of the direct recovery method. Representing 5 p.ct. of the selling price of sulphate at the present time, such a saving is worth serious consideration.

Recovery Methods and the Effluent Problem.

Effluent liquors from ammonia recovery works are chiefly objectionable on account of their ability to absorb oxygen from water into which they are run. Three main types of component are responsible for the oxygen-absorbing characteristics of the effluent—namely, tar acids, thiocyanates, and thiosulphates. The relative proportions of these constituents vary considerably according to the source of the effluent and its previous history. The following figures calculated from some given in the 61st Alkali Inspector's Report, and from figures given by Dr. A. Parker ("GAS JOURNAL," Feb. 14, 1928) illustrate the point:

Oxygen Absorbed by Constituents of Effluents.

(Expressed as percentages of the total absorbed by the effluent.)

—	Horizontal Retorts Total Effluent.	Vertical Retorts Total Effluent.	Vertical Retorts Still Effluent.	Vertical Retorts Devil Liquor.	Direct Recovery Aqueous Condensate.
	P.Ct.	P.Ct.	P.Ct.	P.Ct.	P.Ct.
Phenols	47·5	51·3	23·2	90·8	96·8
Thiocyanate . .	32·0	15·9	43·9	0·92	1·7
Thiosulphate . .	9·9	3·6	5·1	0·7	1·5
Other bodies . .	10·6	29·2	2·8	7·6	—
	100·0	100·0	100·0	100·0	100·0
Total oxygen absorbed, parts per 100,000 . . .	610	1130	990	1635	1158

Methods of treatment have been developed of two kinds: (1) Treatment to destroy the oxygen-absorbing power; (2) methods of extracting phenols. It is obvious from the above table that the only effluents which would be rendered practically innocuous by extracting phenols would be the devil liquor quoted, and the direct recovery effluent. Devil liquor only represents from 10 to 15 p.ct. of the total effluent from indirect recovery, so that such treatment in that case would not solve the problem. With regard to the direct recovery effluent, more will be said later. The only satisfactory treatment yet devised for destroying the oxygen-absorbing power is bacterial treatment on the lines of sewage treatment. Unfortunately ammonia effluents have an oxygen-absorbing power from 50 to 100 times as great as sewage, and the bacterial treatment is thus rendered much more tedious. The effluent has to be many times diluted with treated effluent, and it has been stated that as many as three successive contact filtrations have to be carried out. The method is the only one available for successful treatment of indirect recovery effluents.

As before mentioned, direct recovery effluent could be rendered innocuous by a method in which the phenols were removed. Various methods have been developed for this purpose, and among the solvents used are benzole, nitrobenzene, trichlorethylene, and light tar oil. It is not known whether the processes have been tried on direct recovery effluents, but such effluents are likely to be more amenable to treatment than any others, on account of the comparatively high content of phenols. It can be calculated that on a works carbonizing coal yielding about 5 p.ct. of water the effluent from a direct recovery installation would only amount to about one-fifth that obtained from the indirect recovery plant.

It seems likely that benzole will be the solvent most commonly employed. Plants are already in operation in America in which the effluent is treated in counter-current with benzole. The latter is freed from tar acids by extraction with caustic soda, and the benzole is returned to circulation.

A process in Germany is said to have been operated with a profit of 14 p.ct. on capital investment when a recovery of 75 p.ct. of the phenols from a liquor containing 0·3 p.ct. was obtained. In the process the liquor is preheated to 65° C., and then extracted with benzole. The benzole is subsequently removed from the benzole-phenol mixture by fractional distillation.

Details have recently been published of a similar process developed by Dr. F. Raschig (B.P. 287,226). In this process the effluent liquor is preheated to 50° to 60° C. by heat interchange at the benzole condenser. In an example given, a counter-current apparatus 6 metres high is used, filled with small Raschig rings 15 mm. in diameter. 2000 litres of benzole per hour flow from bottom to top of the apparatus, while 6000 litres per hour of waste liquor flow downwards through the apparatus. It is claimed that, in addition to phenols, other organic compounds, such as naphthalene, pyridine, and pyrrole, are removed from the effluent. Of the phenols, 90 p.ct. is said to be removed, and it is claimed that the type of Raschig rings employed enables this high recovery to be obtained as compared with only 40 to 50 p.ct. recovery with other fillings.

In considering the amount of phenol recovered in the above processes, it is to be noted that only one extraction is allowed for. The partition coefficient of the phenols (Cw/Cb) at elevated temperatures such as 50° to 60° C. must be low to allow

of an extraction as high as 90 p.c. in one washing. Probably a second extraction in similar conditions would remove practically all the phenols from the aqueous phase. It is customary with the American processes utilizing benzole extraction at ordinary temperatures, and separation of the phenols by alkaline washing, to have two or more counter-current units in series to allow of a sufficiently exhaustive removal of the phenols from the effluent.

The partition coefficient for pure phenol between water and benzene, C_W/C_B, is 0·43 at 25° C. (J.C.S. 1925, 127, 1274), and it can be calculated that three successive extractions of a weak phenol solution in water with equal bulks of benzene will extract 96·3 p.c. of the phenol from the water. An approximate laboratory method has been developed on these lines and applied to certain liquors and effluent with the following results:

—	Works B (Horizontals).		Works D, Horizontals	Works C, Verticals.	
	(1) Liquor from Scrubbers and Livesey Washer.	2) Liquor from Hydraulic Circulation.	Liquor.	Liquor.	Direct Recovery Condensate.
Tar acids extracted by benzole parts per 100,000 . .	*nil*	33	55	154	385
Ammonia, p.c. .	3·08	0·83*	1·96	1·52	0·0162†

* Fixed ammonia was 0·37 p.c.

† Includes pyridine amounting to 0·0213 p.c.

The figure obtained above for the phenols in direct recovery condensate is lower than that given by Dr. Parker for a similar condensate—*i.e.*, 630 parts per 100,000. The difference might be due to the amount of water condensed, to the temperature of the cooler, or to its design. In the case quoted above, where 385 parts per 100,000 were obtained, the cooler was serpentine in form and cooled the gas from 75° C. to 38° C. The water yielded from the coal was estimated at 15 p.c. of the weight of coal carbonized, and about 13 p.c. was assumed to be deposited in the cooler. Together with the water, a naphthalenic oil also separated, amounting to 1·6 gallons per ton of coal. This had the following composition:

Naphthalene . .	59·4 p.c.	(Determined by fractionation and picric acid test following.)
Tar acids	9·0 p.c.	

The oily condensate is separated from the aqueous liquor and run into a storage tank. If allowed to cool to atmospheric temperature, it sets solid, owing to the high naphthalene content.

It is of interest to note the distribution of tar acids. 30 gallons of aqueous condensate represent a tar acid content amounting to 0·1145 gallon per ton of coal carbonized, while 1·6 gallons of oily condensate represent tar acids amounting to 0·144 gallon per ton of coal. Thus the total tar acids removed at the cooler amount to 0·2585 gallon per ton of coal, or expressed as a percentage of the tar yield (at 9 gallons p.c. ton) they amount to 2·87 p.c. An interesting consequence of this is that the tar separated from the hot gas prior to the saturator is low in tar acid content and also low in naphthalene. Its viscosity is high, and it only requires dehydrating to render it suitable for tar macadam manufacture.

The aqueous condensate from the direct recovery plant is white, and the tar acids recovered by benzole are initially very pale. It is probable that the content of phenol is high and that the higher tar acids are absent—a fact which might be expected from the method of recovery which amounts almost to a kind of fractional condensation.

F. W. Skirrow (J.S.C.I., 1908, pp. 58-61) states that the ammonia liquor in the indirect recovery process contains pure phenol amounting to nearly half the pure phenol produced in the retorts. The amount of tar acids which finds its way into the liquor has been proved to depend largely upon the time of contact with the tar. Greater attention is now paid to early separation of the tar from the liquor; and loss of tar acids as high as that indicated by Skirrow is not so likely at the present time. The loss is, however, still appreciable. Reference to the above table will indicate a possible method of practice to reduce the loss to a minimum. At works B it was found that the extractable phenols in the liquor from the scrubbers and Livesey washer were *nil*. The liquor from the circulation in the hydraulic main had also a low content of 33 parts per 100,000, but the bulk of this liquor is rendered large by the addition of excess water. It would seem that, by recirculating such liquor without adding more water than is necessary to make up evaporation loss, the amount of tar acids removed would be further reduced. An additional advantage would be that the fixed ammonia content would rise and the liquor would show a tendency to separate more readily from the tar. It would only be diluted when the fixed ammonia content became too high.

It is of interest to compute the value of the phenols in the direct recovery effluent. The volume per ton of coal amounted to 0·1145 gallon. Assuming a recovery of 25 lbs. of sulphate of ammonia per ton of coal, the phenols recoverable in relation to 1 ton of sulphate amount to 10·26 gallons in the aqueous condensate. At 2s. per gallon these are worth £1 0s. 6d. Dr. Parker states that an average figure for the volume of indirect recovery effluent from horizontal installations would be about 50 gallons per ton of coal, and for vertical retorts 75 gallons per ton. He gives 0·108 p.ct. and 0·218 p.ct. as figures for the corresponding phenol contents. Assuming a recovery of 22 lbs. of sulphate per ton of coal, the value of the phenols passing away in the effluent per ton of sulphate made is:

	£ s. d.
At horizontal retort plants	0 11 0
At vertical retort plants	1 2 2

The recovery of phenols is stated to be worked at a slight profit at a plant in Germany. It has been pointed out that the success of such processes is much more likely on effluents such as those from a direct recovery plant, and incidentally it is of importance that in the recovery of the phenols from direct recovery effluent the obnoxious oxygen-absorbing capacity is removed. In the case of indirect recovery effluent, removal of the phenols can only reduce the oxygen absorption to about half.

Conclusion.

The possibility of cheapening recovery of sulphate of ammonia at gas-works by the adoption of direct recovery methods has been discussed, and an attempt made to determine the conditions necessary for successful operation. The suggestion seems to the writer the only immediate course open for adoption. It has long been realized that a great step could be made if the cost of the sulphuric acid used could be eliminated, and that the sulphur in the gas is more than enough to provide the sulphate radicle required by the ammonia. Many processes have been devised and have been discussed elsewhere (J.S.C.I., 1927, pp. 1T-20T), but success has been very limited. Calcium sulphate is used extensively for synthetic sulphate manufacture, but K. Gordon has pointed out that its use is only suitable for very large ammonia output plant, in view of the complication of the method. A new process has been very recently developed by the I.G. Farbenindustrie Aktiengesellschaft, in which the ammonia is fixed as thiosulphate and polythionate; the sulphuretted hydrogen in the gas taking an important part in the reaction. A gas washing solution containing a mixture of ammonium sulphite and bisulphite having the ratio $NH_3 : SO_2$ equal to 1·2 to 1·75 : 1 is primarily employed. The bisulphite partially disappears in the reaction with ammonia, and the sulphite content is increased. The H_2S is absorbed in the production of thiosulphate and polythionates. The solution is regenerated in a separate washer by means of sulphur dioxide. The success of the process would seem to depend upon the market outlet for the mixed salts produced (B.P. 285,999).

The direct process of ammonia recovery has been shown to have potentialities for the successful solution of the effluents problem. The effluent by this process from a gas-works would be only one-fifth the amount usual at present. The noxious constituents have been shown to be practically confined to phenolic bodies which exist in sufficient concentration to render probable their successful extraction by solvents such as benzole. In fact it appears likely that such extraction could be made a profitable proposition in view of the market value of the phenols. In conclusion it may perhaps be suggested that a process which is capable of solving the effluent problem without adding to the present cost of sulphate recovery, and by which sulphate can be made with a saving of probably 5 p.ct. of the selling price, is well worth the complete investigation which undoubtedly is being undertaken.

I am indebted to several members of the technical staff of the Newcastle and Gateshead Gas Company for assistance, and to Mr. F. P. Tarratt, Chief Engineer, for permission to publish this paper.

Discussion.

The President, opening the discussion, said that the problems of the cost of ammonia recovery and the disposal of the effluent were very important. It was necessary to cheapen ammonia recovery, in view of the large production of synthetic ammonia. Moreover, certain countries which were customers before the war were now competitors. For five years up to 1912, the United States, on an average, took from this country 50,000 tons per annum of sulphate of ammonia, and Germany took 13,000 tons. Now both these countries were strong competitors in the world's markets.

Dr. W. B. Davidson (Newcastle-on-Tyne) remarked that the author had made out a good case for direct recovery. To his mind there was no difficulty in adopting the direct or the semi-direct process in a gas-works. The question was, was it worth while? They had tried liquid purification in Birmingham fifteen years ago, and they found that this entailed loss of ammonia. When the process was carried out in Belfast many years ago, they lost from 40 to 50 p.ct. of the ammonia, but he thought that Birmingham had now reduced it to about 9 or 10 p.ct. This loss was the most serious obstacle to the adoption of the process; but, if the ammonia was worth practically nothing, the objection was removed. Mr. Sensicle had not mentioned the disadvantages of direct recovery.

Mr. W. W. Atley (Stockton-on-Tees) dealt with the question of the cost of sulphuric acid, and the use of a substitute for making sulphate of ammonia.

Mr. D. Currie (South Shields) mentioned that sulphate plants at

gas-works carbonizing about 20 tons of coal a day were worked intermittently. A scheme for direct recovery necessitated continuous operation of the plant, and therefore entailed the labour of three men. He would like Mr. Sensicle to state what he considered the smallest works where direct recovery would pay. Of course, coke ovens could cease gas-making if a serious breakdown happened, but gas companies were under a statutory obligation to maintain the supply. In gas undertakings, no matter what the size, they would require to have the plant in duplicate. They would need two separators—one as a stand-by. Direct recovery would put more work on the purifiers. Also, what effect would the passing of the gas through the bath have on the calorific value? At one stage the gas would pass 2 or 3 p.ct. of acid, but it might rise later to 10 p.ct. They would expect to have a small loss in calorific value at 2 p.ct., but what would it be at 10 p.ct.? If the greatest economy was to be obtained, it was necessary that the recovery plant should be as close to the retorts as possible. He was not aware that any gas-works in 1915 had the direct recovery process. There were some with semi-direct recovery, but in those cases the gas was cooled.

Mr. W. DIAMOND (Hull) said that the effluent question was a bugbear to all of them. Did the recovery of ammonia pay? While he was in London he heard that a site had been purchased in Scotland where a plant was to be erected for the production of 1000 tons of sulphate of ammonia a day. The time would undoubtedly come when gas-works would not be able to make the ammonia as cheaply as could this concern.

Mr. F. NICHOLLS (Redheugh Gas-Works, Gateshead) spoke of the trouble with the pipes in connection with the direct process. The difficulty in washing with liquor was the loss in benzole.

Mr. A. C. HOVEY pointed out that the paper showed the necessity of having a trained chemist to deal with many of the questions which they had to face.

Mr. SENSICLE, in reply, said that the profit which might be made on the phenol extraction process, which also solved the effluent problem, was a point in its favour. He would say that the direct recovery process for ammonia could easily be worked out at works making a million c.ft. of gas a day. Three men per day to look after the separators was a matter of Trade Union control. Some works seemed to have men doing several jobs, including the running of plant of this kind. Bubbling through the acid could go on during the whole of the 24 hours, and a man could be allocated to attend periodically to the strength of the bath. His experience of coke oven work was that there had not been any measurable effect on the calorific value of the gas. The weight of the tarry matter removed from the separator would not affect the calorific value to any appreciable degree. Regarding gas-works using the direct process in 1915, and some using the semi-process, he said they were not even using a "quarter-direct" process.

WALES AND MONMOUTHSHIRE DISTRICT INSTITUTION OF GAS ENGINEERS AND MANAGERS.

GENERAL MEETING AT TREDEGAR.

Optimism as regards the gas industry was the keynote of the well-attended general meeting last Thursday in the Drill Hall, Tredegar (Mon.), under the Presidency of Mr. D. WALTER DAVIES, who is Engineer and Manager of the Tredegar Urban District Council Gas-Works. Mr. Davies also has charge of the water undertaking; and the indebtedness of the ratepayers to him for his successful working of these two important municipally-owned concerns was freely acknowledged by the Councillors who were present to welcome the members.

THE COUNCIL'S WELCOME.

The PRESIDENT, at the opening of the proceedings, said he was sure they were all glad to have with them the Chairman, the Vice-Chairman, and a member of his Council, who were present to extend to the members a civic welcome. The Council had, indeed, left no stone unturned to ensure the success of the meeting; and for this he personally was extremely grateful to them.

Councillor W. R. HOPKINS, J.P. (Chairman of the Council), remarked that it was a great pleasure to welcome heartily the members to Tredegar. The Institution had paid the town the compliment of electing Mr. Davies President—an honour which he fully appreciated. Mr. Davies was very conscientious, very reliable, and very thorough; and he was a man of his word. The Institution would certainly find him a "live wire." The more they gave him to do, the better pleased would he be. He wished both Mr. Davies and the Institution every possible success, and hoped the members would leave Tredegar with pleasant memories of their visit.

Mr. THOMAS MORGAN (Vice-Chairman) associated himself with the welcome and the good wishes of the Chairman.

Councillor S. FILER, O.B.E., J.P., also voiced the pleasure of the Council and of the town at having the members of the Institution among them.

MINUTES AND APOLOGIES.

The HON. SECRETARY (Mr. Octavius Thomas, of Pentre) read the minutes of the last general meeting, and they were confirmed. He also intimated the receipt of apologies for absence from Presidents and Secretaries of various kindred Associations. Mr. H. D. Madden wrote expressing his keen disappointment at being unable to be present, and his wishes for a successful meeting.

NEW MEMBERS.

The following were elected members of the Institution:

Mr. William George Thomas, Engineer and Manager to the Mountain Ash Urban District Council Gas-Works.

Mr. H. Broomhead, Manager to the Builth Gas and Coke Company, Ltd.

Mr. George Edward Childs, Engineer and Manager to the Ferndale Company, Ltd.

PRESIDENTIAL ADDRESS

Of Mr. D. WALTER DAVIES, of Tredegar.

At our meeting in Porthcawl I expressed my appreciation of the honour you had conferred upon me in electing me to the Presidency of this important Institution. It is the highest honour you could do me, and I sincerely hope that at the conclusion of my period of office you will feel that your confidence was fully justified. I would like to say here how gratified I am that my Council have signified their appreciation of the occasion by inviting you to hold this meeting at Tredegar. I am well aware that all honours carry with them corresponding duties; and when I view our formidable list of Past-Presidents and recall how ably they filled the office, I must confess I occupy the Chair in "fear and trembling." However, my experience of you is such that I know—whatever shortcomings I may reveal—you believe me when I say how anxious I am to sustain the best traditions of this Institution, of which I am one of thirteen remaining of the forty-seven original members.

THE PRESIDENT,

D. Walter Davies, of Tredegar.

Mr. Davies entered the gas industry in 1898 as Secretary of the New Tredegar Gas and Water Company, Ltd., and two years later was also appointed Manager. Since 1905 he has held the office of Engineer and Manager of the Tredegar Urban District Council's Gas and Water Undertakings, and since 1913 Street Lighting Superintendent to the Council. He also holds the appointment of Chief Officer of the Council's Fire Brigade.

My thoughts go back to the first meeting of the Institution, held on Sept. 6, 1905, when the late Mr. Thomas Canning, J.P., delivered that masterly, instructive, and optimistic inaugural address filling twenty pages of the Reports of Proceedings of the Associations of Gas Engineers and Managers, and, after holding, especially the youngsters among us, of whom I was one, spellbound, winding up with the following:

> It was difficult indeed for me to find anything new to say to you, and I have therefore confined myself to that aspect of our industry affording indication of how best to maintain and further to advance our position with the public. I have touched a fringe of new ground, I have thrown, it may be, a fresh light on old paths, but still I can only look upon myself as a gleaner passing over fields fully reaped by others—a sort of Autolycus, in fact, who in a different sense concentrates his attention upon "unconsidered trifles."

Our first President might have been a gleaner, but he was also a sower of the first order; and I am glad to say, so far as I am concerned, the seed did not fall on stony ground. I make this reference to the late Mr. Canning not solely be-

cause he was the first President, but also as a sincere personal acknowledgment of the benefit I have derived from the advice he was always willing to give and from the many addresses and papers he gave to the Institution. I fear it is one of our failings that we are prone to forget the men of the past, who were the pioneers of our industry, and to whom we owe so much. As the President of another Institution so ably put it some time ago:

> Too often do we forget those who first force their way along unknown paths which in the future become well-frequented thoroughfares; who first point out to what important ends such paths lead; who persevere through weal and through woe, through opposition and calumny; who never falter in their struggle along the paths they see dimly before them, or even when they must needs grope blindly along the absolutely unknown. Too often is the honour due to these pioneers pushed into the limbo of obscurity by the very weight of the chain, the initial links of which they themselves helped to forge.

The Institution.

It is very gratifying to note that the Institution has grown in membership from 47 in 1905 to 84 in 1927; and even these figures do not represent our true growth, as we have also extended our sphere of influence—commercially by the formation of the Commercial Section and educationally by our interest in the work of the Wales and Monmouthshire Junior Gas Association, with our appreciation of such work by awarding prizes to successful candidates in the examinations held by The Institution of Gas Engineers and by the Cardiff Technical College. It augurs well for the future of the industry that the Junior Association is receiving such valuable and unselfish assistance from many of our members; and in this respect I am sure you will not take exception to my singling out one member in particular. I refer to Mr. H. D. Madden. Recently, during a conversation with Mr. Mogford—though I am fully conscious we always receive the utmost courtesy from the engineers of the larger works in Wales and Monmouthshire—I was really astounded to learn the trouble they take at the Cardiff Gas-Works in providing facilities for students to obtain practical knowledge of the various subjects, even going so far in some instances as to dismember plant and machines solely for the education of the students. If this is a criterion of what is taking place throughout the country, we can look forward with all confidence to even greater efficiency in our particular industry.

Tredegar Gas-Works.

It is a great pleasure to me to see so many of you present to-day, and my one regret is that I cannot show you anything exceptional either in the manufacture or in the distribution of gas. The gas-works which it is my privilege to control are near to this building, and are open for your inspection should you have the time and feel disposed to visit them. No special preparations have been made in so far as the works are concerned. The general clearing up which usually precedes an occasion of this kind has not been done. The chief reason for this is that we are just about to commence extensive alterations, in connection with which trial holes have already been made on the site formerly occupied by our coke stock, with the result that coke and other material are being dumped wherever room can be found. The works cover an area of an acre and a half; and a short description is as follows:

The carbonizing plant is installed in two retort houses with stage floors; No. 1 House containing two settings of six, and No. 2 House containing four settings of eight, horizontal stop-ended retorts, ⌂ section, 22 in. by 16 in. by 10 ft. long, all charged and discharged by hand.

There are two railway sidings. The high-level siding passes through the No. 2 Retort House at charging floor level, and by this arrangement, except in remote cases of emergency when it is necessary to use from stock, the stokers unload the coal from the railway wagons direct into the charging barrows as required. The low-level siding is used for tar, oxide, and other works traffic which cannot be dealt with on the high-level siding.

The condensing plant consists of one water-tube condenser of a daily capacity of 400,000 c.ft.

The exhauster house contains two Waller exhausters driven by horizontal steam engines, one of a capacity of 15,000 c.ft. per hour and the other of 10,000 c.ft. per hour.

The washer is of the Livesey type of a capacity of 500,000 c.ft. per day, and the scrubber is 6 ft. in diameter by 54 ft. high.

The purifying plant consists of four elevated boxes each 15 ft. by 15 ft. by 5 ft., controlled by a 12-in. Pickering valve.

The station meter has a nominal capacity of but 10,000 c.ft. per hour. There are three gasholders of a capacity of approximately 190,000 c.ft., 100,000 c.ft., and 45,000 c.ft., respectively; the largest having provision for an additional lift. The total storage is about equal to the maximum day's output. The supply to the district is controlled by one 12-in. governor.

The output for the past year reached almost 70 million c.ft., so you will appreciate how inadequate the works are, especially in so far as the carbonizing plant is concerned. You will observe we have no water gas plant, and we are, therefore, totally dependent on 44 22 in. by 16 in. by 10 ft. retorts (44 mouthpieces) in a works with a maximum day's output of 315,000 c.ft. How different from those ideal conditions recommended by a recognized authority, thirty-five years ago, when 60 21 in. by 15 in. by 20 ft. retorts (120 mouthpieces) were stipulated for a maximum output of 500,000 c.ft. per day. Post-war conditions and prices, with our inherent cautiousness, are responsible for our present somewhat precarious position; but I am glad to say that next winter will probably be the last with the existing plant. Extensions have been contemplated since early in 1924. A Committtee has been sitting almost continually since April, 1926. Visits have been made to various works, far and near, and all types of carbonizing plants have been inspected, with the result that we have decided to instal verticals. In fact, tenders have already been received; and, had the local election not intervened, with a consequent change in the constitution of the Council, I have no doubt the order would have been placed ere this. I can see some of you smiling at the idea of verticals for a 70 million works using a South Wales through coal; but you may take it from me that if you had had thirty years' experience of hand-charged horizontals, with their labour and other difficulties, and cost of working, and had seen the results obtained from verticals using similar coal over a period of seven years, you would have no hesitation in following our example. At one works we saw machine-charged horizontals and verticals working at the same time; and though there was ample room to extend the horizontals, additional verticals were being built at the time of our visit. Unfortunately the delay in proceeding with extensions has meant restricting the number of new consumers, though during the year just ended, 95 were added to the roll.

Some of our carbonizing figures for the year ended March 31 may be of interest to you:

Gas made	69,806,100 c.ft.
Coal used	4,888 tons.
Yield of gas per ton of coal	14,281 c.ft.
Coke for sale per ton of coal	9½ cwt.
Tar produced per ton of coal	8¾ galls.
Quantity of coal charged per man per shift	37 cwt.
Cost of production per 1000 c.ft. (stokers' wages only)	5½d.

Distribution.

Regarding distribution, our district has been for many years badly affected by subsidence caused by coal mining operations. The unaccounted-for gas has consequently been high and variable. In a recent report to my Council I gave details for the past forty-five years. These figures, though interesting to some, would probably weary most of you if given *in extenso*. I will therefore content myself by quoting certain years only, as follows:

Year.	P.Ct.
1885	13·76
1889	6 5
1897	25·4
1904	3·9
1907	29·5
1912	31·24
1919	17·72
1923	26·05
1924	23·55
1925	23·14
1926	16·00
1927	15·00

You will therefore appreciate how serious our losses have been in this direction; and the financial loss, though great, is not all. Gas leakage caused by mining operations is to my mind the greatest worry gas engineers and managers experience in these districts. However careful we are, mains and services break, causing escapes, sometimes with grave results; and there is always the possibility of the engineer being called to defend himself against a charge of negligence. I remember on one occasion being called out, by the police, at three o'clock on a winter's morning, with the report that a road was ablaze about a mile from my house. The trouble was traced to a broken gas main caused by subsidence. Fortunately, the main was in a side road, and the only damage was to a fowlhouse, wherein five fowls were burnt to death and nine others depreciated in value—so the owner claimed—to the extent of 2s. 3d. each. The point I wish to bring out is that, though the main was only five years' old, and had originally been well laid, it was suggested that the damage was "caused as a consequence of the Council's failure to maintain such mains in repair."

A list taken at random from one of my monthly reports to the Council, typical of what happens in our district, is as follows:

Broken mains	4
Broken services	15
Drawn joints	13

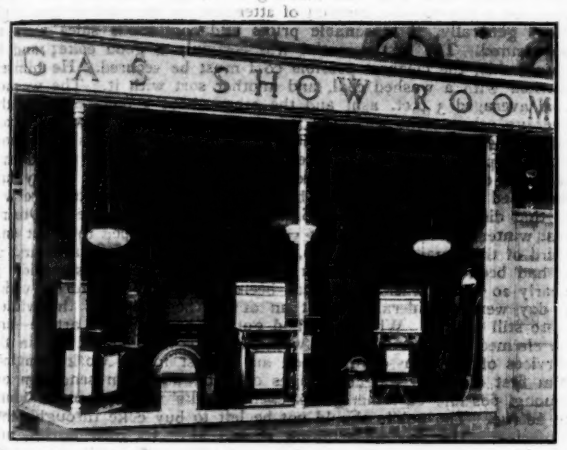
I believe we have adopted every known method of dealing with the trouble. Some years ago the cast-iron mains in the district most affected were substituted by about four miles of what was then known as "unbreakable" steel; but even

this has its limitations, as you will see from the piece of fractured steel pipe I have brought for your inspection.

Bearing on the same subject of subsidence, we experience similar trouble in connection with the waterworks, which I also control. The difficulties are greater, however, because we supply a population of about 50,000, and the mileage of main is consequently greater than in the case of gas. Our Georgetown Waterworks are so badly affected that the filter beds are now out of level to the extent of 3 ft. In passing, I would like to say that we have a very fine mechanical filtration plant with alumina and chlorine apparatus at our Nantybwch Waterworks, about two miles from the centre of the town. The plant is reputed to be capable of dealing with one-and-a-half million gallons of water per day, and, I am told, is similar in capacity and design to that erected at one of the London gas-works. The plant and buildings cost £18,000, and I am specially interested, inasmuch as it was on my recommendation and under my supervision that the plant was installed. If any members would like to make an inspection, I shall be pleased to accompany them and explain the whole system.

Showroom.

We have a very useful showroom on the main road near the entrance to the works. The building was opened thirteen years ago, and has well fulfilled its purpose. A more ideal



spot would, of course, be in the centre of the town, though within a radius of 700 yards of the present building there is a population of almost 10,000.

Street Lighting.

I also have charge of the street lighting of the district, consisting of 433 gas lamps, 8 electric lamps, and 27 oil lamps. The oil lamps are in remote villages in the northern part of our district, and the electric lamps are in two villages situated near collieries, from which they are supplied.

The gas lamps consist of:

2	10-light arcs.		
55	2	,,	,,
3	8	,,	square lanterns.
5	6	,,	,, ,,
3	4	,,	,, ,,
112	3	,,	,, ,,
2	2	,,	,, ,,
251	1	,,	,, ,,

The burners are of the Universal, No. 2, bijou types. All are fitted with controllers. 308 are pressure controlled, and the remaining 125 clock controlled. I believe Tredegar is the only town, within the area covered by the Institution, with pressure controllers. The system known as the "Bamag" has been in use in this district for over fifteen years. The controller is on the diaphragm principle, and is operated by a pressure wave sent out from the works. The only advantage over the clock controller, to my mind, is that you can light and extinguish at will, provided the mains are not overloaded at the time; but this latter provision almost nullifies any benefit that otherwise might be obtained. The great difficulty is to get the leading stoker to become so competent as to be able to decide day by day the proper time for lighting. No lighting table, based on the time of sunset, would be of any service, as everything depends on weather conditions; and, in fact, however competent the operator may be, the lighting-up time cannot be cut so fine as with clock controllers. For any street lighting required after midnight, the system is successful, but the necessary increases and decreases of pressure required to operate are, to say the least, rather undesirable at a time when the majority of people are in bed. I have known of one or two cases where, through carelessness on the part of the operator in reducing pressure after giving the wave, small lights in bedrooms have failed. Needless to say, every effort is made to prevent a recurrence of this. To operate the pressure controllers when holders are uncupped, we have a very efficient Donkin pressure raiser driven by a Pelton wheel.

Generally, the street lighting in Tredegar is considered to be of a very high standard. Some time ago the Council went so far as to express the opinion that we had the best-lighted town in South Wales. The Press, of course, published this, and the next time I met our esteemed Hon. Secretary, Mr. Octavius Thomas, he made no verbal comment, though his countenance spoke volumes.

Fire Brigade.

As some of you are aware, I have charge not only of the gas and water departments, but also of the fire brigade. You will probably think it a peculiar combination of departments; but on considering the question in all its bearings, I think you will agree, without exception, that such a combination should mean a high standard of efficiency. The members of the brigade are chiefly drawn from the employees of the gas and water departments—and who could be more familiar with buildings and water mains in the district than these men? I recall a striking precedent for this combination of duties. I refer to my native town of Blaenavon, where that able man in many spheres of life, one of the founders of this Institution, the late Mr. Charles White, J.P., filled the post of Engineer and Manager to the Gas and Water Company, and also was Chief Officer of the local fire brigade. If I can make my brigade as efficient as his was, I shall be satisfied.

Electricity.

We have no public electricity supply in Tredegar, though as far back as twenty-three years ago, when I came here, one of the conditions of my appointment was that I should take charge of any electricity scheme the Council might put into operation, I think it is somewhat unusual to find a town with a population of 27,000 without an electricity supply. The subject has been discussed over and over again, and schemes have been prepared, but the cost has in each case been prohibitive.

All the towns and villages in our immediate neighbourhood have been "electrified" during the past few years; and when I am satisfied that a supply of electricity will be beneficent to our town I shall be the first to recommend its adoption. The net price of gas in Tredegar is 3s. 9·9d. per 1000 c.ft., and I hope we shall soon be able to make a further reduction. I therefore do not see how it is possible to benefit the already overburdened ratepayer by introducing electricity.

What a remarkable example we had some months ago of the preference the poorer people have for gas lighting! I refer to the Cardiff case, where Council houses were already supplied with Corporation electricity, yet the tenants had gas, supplied by a Company, installed even for lighting purposes.

I remember that thirty years ago, when I entered the gas industry, when at that time electricity was being boomed in Cardiff, the general opinion was that the gas industry was doomed, and had but a short period to live. I was a youth of 18, and you can well imagine how I questioned the wisdom of boarding what appeared to be a sinking ship. Yet, now, thirty years later, what do we find? Not the dust and bones of a departed industry, not even a decaying industry, but an industry more alive and robust than ever—an industry which shows so far as Cardiff is concerned an increase in the annual sales from 740,358,000 c.ft. to 1,906,099,000 c.ft. What amazing progress! What would the coal and other industries give for such prosperity?

Gentlemen, in conclusion, after a careful mental survey of the past and present of our great industry, I am compelled to strike a note of extreme optimism, and to express the opinion that industries may come, and industries may go, but the gas industry, like Tennyson's "Brook," goes on for ever.

The President Thanked.

Mr. W. H. Johns (Swansea) said they had listened to a most interesting address. The members had shown their high opinion of Mr. Davies by electing him President; and it was very gratifying to see that this appreciation of his work was shared by the members of his own Council. Already he had charge of no less than three of the leading municipal departments; and he contemplated adding to his activities, when the time came to do so, the office of Engineer and Manager of the electricity undertaking. Thus he was a busy man; and his address proved that he was an up-to-date man, in whom his Council could safely place the utmost trust. He devoted his energies to ensuring that his consumers should receive a cheap and efficient supply of gas; and this was the duty of all of them. It was astonishing to find that in Tredegar they were able to sell gas to-day at the very low figure of 3s. 9d. per 1000 c.ft.—and, he understood, at a profit. He proposed a hearty vote of thanks to Mr. Davies.

Mr. B. Grainger (Caerphilly) seconded the vote, which was carried with acclamation, and suitably acknowledged by the President.

Annual Report and Accounts.

The annual report, which was next submitted, contained the following:

The Council have pleasure in presenting their twenty-third

annual report. During the year two members have joined the Institution, two students have been transferred to membership, one student has joined, and one student has resigned, leaving the numbers at the end of the year at 76 members, 6 students, and 3 honorary members. The receipts for the year amounted to £83 5s. 6d., and the payments to £113 5s. 9d., leaving, after taking into account the balance brought forward from last year, a sum of £16 3s. 6d. in the hands of the Treasurer, and £100 in 2½ p.ct. Consols. The cause of the excess expenditure was the presentation of medallions to the Past-Presidents. The Council have much pleasure in reporting the election of one of their members, Mr. H. D. Madden, as President of The Institution of Gas Engineers for this year, and hope that all will assist in making the meeting in Cardiff in June very successful.

The report and accounts were adopted on the proposition of Mr. E. Ablett (Swansea), seconded by Mr. J. Mogford (Cardiff).

List of Office Bearers.

The following is the list of officers appointed for the ensuing year:

President.—Mr. F. Boardman, of Cardiff.
Vice-President.—Mr. L. Murray, of Blaina
Members of Council.—Messrs. E. Ablett, A. E. Davey, and I. G. Jenkins.
Hon. Treasurer.—Mr. J. H. Canning, of Newport.
Hon. Secretary.—Mr. Octavius Thomas, of Pentre.
Hon. Auditors.—Messrs. T. Wilkinson and J. Stephenson.

The New President.

The President, proposing that Mr. Boardman be the new President, said he was quite convinced that this would be in the best interests of the Institution.

Mr. W. Clark Jackson (Neath), who seconded, remarked that Mr. Boardman possessed all the necessary technical and other qualifications for the position of President.

Mr. Boardman undertook to do his utmost to carry out the duties of the office to the satisfaction of the members.

Institution Benevolent Fund.

The Hon. Secretary proposed that they should again subscribe £10 10s. to the Benevolent Fund of The Institution of Gas Engineers; and he expressed the hope that those members who had previously given a personal subscription in addition would do so again this year.

Mr. Johns seconded the proposition, which was agreed to.

PRESENT-DAY PROBLEMS.

By T. Anthony Canning, F.C.S., of Woking.

This paper, which will be found on pp. 49-51 of the "Journal" for Oct. 5, 1927, was submitted at the Porthcawl meeting of the Institution in September; but there was no time to discuss it on that occasion. Mr. Canning now went over the main parts of his contribution, and the following discussion ensued.

Discussion.

The President voiced the obligation of the members to Mr. Canning for his paper, which had not only dealt with problems, but had also gone a long way towards providing solutions of them.

8-Hour and 12-Hour Charges.

Mr. J. E. Kenshole (Merthyr) remarked that the author referred in his paper to 8-hour and 12-hour charges. This was a question that had exercised the minds of many people some time ago. Speaking personally, he had been forced to make the experiment of 12-hour charges in the troublous times of 1921. He worked in this way right through the strike then; but he was never satisfied with it. Difficulties cropped up, and so when the strike came to an end he reverted to 8-hour charges. He could not quite understand at the time why the experiment had not been a success. However, during the last strike of 1926, he was again compelled to adopt the 12-hour charges; and he was careful then to avoid the mistakes which he recognized had previously gone a good way towards preventing the system from being successful. The result was that, from that day to this, he had not gone back to 8-hour charges. For one thing, it was found that on the first occasion they had not reduced the heats sufficiently when changing-over to 12-hour charges; and so a further reduction was made when this method was adopted for the second time. Then, again, on the latter occasion they did not attempt to make into, and distribute from, the one holder. They found that they could get a straight line by making the gas into one holder, blowing from that holder into what he might call a distributing holder, and distributing from that. In this way there was ample time for the gas to become thoroughly mixed. Among the advantages of 12-hour charges was the fact that the retorts were bound to last longer. Charging and discharging did not take place so frequently; and, as he had said, the heats were reduced. When he started the 12-hour charging during the last strike, he altered the period of charging. They worked two eight-hour shifts, with four-hour intervals between. The retorts charged at intervals of 1½ hours during the shift were six in number; but for the first and last charges—those at 10 o'clock in the morning and 5.30 in the afternoon, and at the same time at night and early morning—the number of retorts charged was doubled. This meant that they had considerably more gas to make during the four-hour interval than would otherwise be the case; and then at the commencement of the shift, by charging a larger number of retorts, the gas got up much more quickly. In this way, and with the method of mixing to which he had already referred—making into one holder, and distributing from a second—he was able to maintain gas of equal quality right through the 24 hours. Fortunately the first holder threw sufficient extra pressure to blow from that into the second holder.

Admixing Water Gas in the Foul Main.

Mr. W. Clark Jackson (Neath) remarked that he was not at all interested in 8-hour or 12-hour charges. He was a "vertical man;" and he hoped the President would find as much happiness in his vertical retorts as he (the speaker) had found in those at Neath. It was not necessary for him to charge extra retorts in order to get a straight-line calorific value gas. At the same time, he had no doubt whatever, from what he had seen at Swansea and Merthyr, that 12-hour charges showed a considerable improvement over 8-hour ones. The reference in the paper to the mixing of water gas with coal gas was interesting to him, because for some time he had worked on the lines suggested by Mr. Canning. He made his carburetted water gas into the relief holder, and drew from there into the foul main—the point farthest away from the exhauster. By this means, they had been able to work down to 370 B.Th.U. carburetted water gas, and still maintain a very steady 425 B.Th.U. (or better) mixed gas. When the carburetted water gas was dropped off, one would expect that the calorific value would go up considerably; but it did not. By mixing the gases in the way he had mentioned, they certainly did derive substantial benefit from some of the hydrocarbons which were in the tar, and which were picked-up by the water gas and carried forward to the holder.

Importance of the Domestic Coke Market.

The coke market, as Mr. Canning had suggested, was one which required a considerable amount of attention on the part of gas engineers generally, if reasonable prices and continuous sales were to be assured. The first essential was certainly a good coke; and to obtain this, the cleanest possible coal must be secured. He himself worked with a washed coal, and another sort with it. The washed coal averaged 3 p.ct. ash, and the other about 5 p.ct.; so that the average ash content was very low, and he obtained coke free from ash. The modern method of steam quenching, too, was very beneficial in providing a light coke. He had tested it, and found that it could quite easily be lighted with paper and sticks. They had developed at Neath one of the best domestic coke markets there was in that district, at any rate. Sales could easily be secured. During last winter one of their largest consumers had dropped to about one-third of the usual requirements, owing to slackness in trade, and so it had been necessary to secure an increased local consumption of nearly 20 tons a week. This had been found; and the stocks, which to-day were considerably less than at the beginning of the winter, were still falling. When they had got the best possible article—and he claimed that vertical coke was the best—they should obtain the services of a canvasser who took an interest in his work, convince him first of all of the advantages of coke, and then send him out among possible customers. Excellent results would then be found to accrue. The public should not be left to buy coke through other agencies. The gas undertaking should have its own lorries, and should see that the coke was delivered on the day and at the hour that it had been promised.

Successful 12-Hour Charges at Swansea.

Mr. W. H. Johns (Swansea) said he was not a "vertical man" at the present moment; but he would be quite prepared to put them in, if he were convinced that they were the right thing for his undertaking. Circumstances, of course, altered cases. Mr. Kenshole had described to them how he had overcome his troubles with regard to unequal quality of the gas, when working 12-hour charges, by charging more retorts towards the end of the working shift. At Swansea it was not necessary to do this. There they worked 12-hour charges, and did not experience the slightest difficulty. The plant was designed for 12-hour charges, and it had been a complete success. They carbonized 18 cwt. in that period; and the gas passing to the town was of consistent quality. It did not matter how one got this consistent quality, so long as one did get it; and in the case of Swansea they had done so. The gas was properly mixed in the holder, by having the inlet on one side and the outlet on the other. The mixture of coal gas and water gas was maintained without the slightest difficulty round about the 450 B.Th.U. which they supplied. There was no need to put in verticals to overcome this difficulty, because it really did not exist.

Grading of Coke.

In the matter of coke grading, he thought he had had as large an experience as anyone, with perhaps the exception of Dr. Smith, who had dealt particularly with coke from vertical retorts. At West Bromwich they cultivated a demand for graded coke many years ago. It was done before he went there. Coke sales in that district were very sluggish; but there was a big demand for breeze, which was cut coke about ¾-in. cube, and was used particularly in connection with the manufacture of chains, and also for smithing work. They were able to obtain a much greater revenue in this way than was possible by selling coke in its natural state. The one disadvantage was the types of coke breaker that were then on the market. A large amount of dust inevitably resulted from the process; and in many cases this dust had to be carted away. It was so fine that it could not be burned under boilers. Of course, any cost thus involved had to be brought into account, and put against the greater revenue derived from the better-class coke. While naturally they all desired to get the utmost they could in revenue from coke sales, it would often be found—especially in that part of the country—that the consumer could buy coal at a much cheaper price than the gas undertaking required for its coke; and although the gas undertaking looked after him in time of stress, he, being fickle, would certainly turn to that coal when it was available.

"Why Sell the Coke at All?"

His argument in these circumstances was: "Why sell the coke at all? At one time you have big stocks of coke accumulating which

you cannot get away; and at other times you have insufficient coke to deal with consumers' requirements. Why not convert it into water gas, often saving a very considerable amount of money involved in bringing coal long distances?" This, Mr. Johns went on to say, was one of the reasons why, at Swansea, they went in for horizontals. They always had been big water gas manufacturers in Swansea; and he thought that when they had raw material in the shape of coke on their own doorstep, it was far better to use it in that way, and bother little about coke consumers—and even make gas more economically, as he believed he would be able to show next month.

THERMAL CONSIDERATIONS.

Dr. E. W. SMITH (London) said his Chairman, Sir Arthur Duckham, had hoped to be present at the meeting, but had been prevented by another important engagement. Therefore he (Dr. Smith) had come down to take his place, and to support Mr. Canning, who was to be congratulated upon the paper which he had submitted. It seemed to him that the whole gas industry would be under an obligation to Mr. Johns if he could show that, generally speaking, it paid to make blue water gas with the main bulk of coke. His own special circumstances—arising from a low return for coke—would possibly justify it; but in the main, throughout the country, the evidence was that therms made in blue water gas from coke cost considerably more than therms made from straight horizontal gas. Mr. Johns would confer a great benefit upon the industry, if he could show them where they were wrong. The next point he would like to raise was that a calorific value straight line was not the all-important matter in any district. It did a great deal more harm to have big variations in specific gravity than to have slight variations in calorific value; and if drops in calorific value of coal gas were made good by the addition of water gas, one would get differences in specific gravity on the district which were much more serious than a drop in B.Th.U.

Mr. JOHNS said the matter of difference in specific gravity was one which had not been lost sight of at Swansea.

COKE BREAKING AND CRUSHING.

Continuing, Dr. SMITH remarked, with regard to the question of coke breaking and crushing, that he thought the main importance of the subject was not so much in the actual breaking or crushing as in the handling of the coke after the right sizes had been obtained. In many works one saw efficient screening plants which were followed by big drops, when more dust was made, and by bad loading and storage arrangements, which resulted in still further dust—thus eliminating the advantage that had been secured by screening. To his mind, the best breaking plant that he had seen was quite a modern type, with which the coke was made to pass under prongs, which came down and broke it by pricking it. This made the smallest amount of dust, and most efficiently broke up the coke to the proper size. Mr. Canning had given them an excellent summary of what he considered should be done in order that they might develop the domestic coke market. When it was realized that the annual consumption of coal for domestic purposes was round about 40 million tons, and that there was probably (after supplying other requirements) a residue of only 4 million tons of coke annually available from gas undertakings for the domestic market, it would be seen that, if they could supply this market with 10 p.ct. of its needs, there would never be any coke left in stock.

A BRITISH COMMERCIAL COKE ASSOCIATION.

To his mind, a bigger outlet for coke in this direction was well worth striving for. In order to secure such an outlet, publicity was necessary; but this publicity must prove quite useless—and, indeed, detrimental—if the material supplied had not the same reliability as the gas itself had under the Gas Regulation Act. Under present conditions, it was quite possible for one town to make good coke, and yet to suffer from the production of a less satisfactory article in another place. Consequently, what were needed for coke were district organizations and selling organizations. The production of coke best calculated to meet domestic requirements must be placed upon a proper basis. It would possibly even pay for a big undertaking to buy the whole of the make of coke from a place where a less desirable article was produced, and use it for water gas making, in order to get off the market bad material which spoilt the sale of the better article. The greatest possible attention should be given to the sale of coke; and why the business men in the gas industry did not give it as a whole, as distinct from individually, he could not conceive. It was no use asking the British Commercial Gas Association to do it, because they were selling gas. They needed a British Commercial Coke Association. No doubt there were difficulties; but they could be overcome.

TAR FOR ROADS.

With regard to the question of tar for roads, he agreed that the whole of their tar—that was, the part which was useful—should be available for this purpose. They knew that it could so be made available; but until really satisfactory tar for road purposes was produced, not only in some parts, but all through the country, they would have surveyors who would be shy of using a material which was liable to great variations unless prepared in strict accordance with the most approved conditions. It could be so produced cheaply, and gave a much greater return in that way than by selling to the distiller; but until reliability was assured, it would be useless to demand of the Government a regulation that tar should be used on the roads, and nothing else.

Mr. A. E. DAVEY asked the author if he could state, for the benefit of those in charge of smaller works, what size of retort could be most usefully employed under the 12-hour, or two shift, arrangement. He had had some experience with this method; and the difficulty had been in keeping the gas of a fair quality throughout. In that case the retorts were somewhat small.

MR. CANNING'S REPLY.

Mr. CANNING said it had been a great pleasure to him to come down and read this contribution. In nine cases out of ten, he thought it was the author who benefited most from the reading of a paper. The speakers in that discussion had made kind and encouraging observations which he could assure them all he deeply appreciated. Mr. Kenshole spoke of the difficulties he had experienced with 12-hour carbonizing when first he tried it. Probably it would be fair to assume that these experiments were made in 8-hour settings. He was, however, glad to hear that, as the result of his second experience, Mr. Kenshole had not had to revert to 8-hour charging. This went to show that he must have made a very deep study of the system. In order to maintain a reasonably straight line during the whole of the 24 hours, it would be found that the plan of double charging at the beginning and the end of the shift was almost an absolute necessity. The reduction of heats referred to by Mr. Kenshole was, of course, also necessary—particularly if he was using settings constructed to deal with 8-hour charges.

The next speaker—Mr. Jackson—had loudly proclaimed himself a "vertical man." He had known Mr. Jackson a very long time, and was aware of his enthusiasm for verticals; but personally he (Mr. Canning) regarded the matter with an open mind, and felt that both verticals and horizontals had a very big future. When verticals first came in, horizontals were thought to be doomed; and in the opinion of many people the horizontal was still doomed. But nevertheless it continued to go on; and he thought that the development of the horizontal retort alongside the vertical was all to the good of the gas industry. He could not visualize the extinction of the horizontal retort for many years to come—particularly in view of more recent developments.

RE-LINING FURNACES WITH SETTINGS AT WORK.

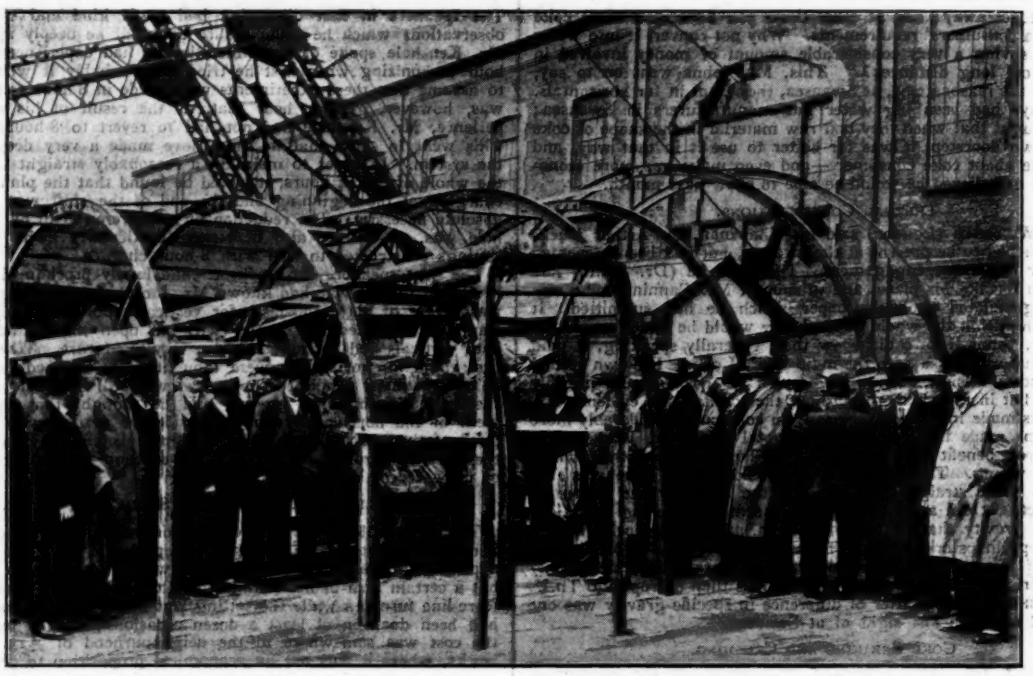
There was, Mr. Canning went on, one matter in connection with horizontal retorts which, though perhaps it did not arise out of the paper, might prove interesting. He would not mention the name, but a certain firm of horizontal retort contractors were prepared now to re-line furnaces while the setting was more or less at work. This had been done on at least a dozen occasions; and he believed that the cost was somewhere in the neighbourhood of £15. In small works, where it was not an economical proposition to drop down a complete setting for re-lining the furnace, it was a real gain to be able to do the work without letting down the setting. The method adopted was comparatively simple; but he could tell them candidly that when he was first approached on the matter he was rather sceptical. In the first place, the retorts were filled with a very heavy charge, and closed up. The combustion chamber was then opened out on one side, and by means of a long pair of tongs a special brick was dropped into each nostril; the secondary air was shut off; and the dampers were closed. The fires were raked out, and asbestos shields were introduced. After that, the men entered the furnace, pulled out the old brickwork, and replaced it with new. The men worked very short hours, as the task proved extremely exacting. The operation of re-lining a furnace occupied from two-and-à-half to three or four hours; and after they had done it, the men took a day's rest. Really, Mr. Jackson was to be congratulated upon his coke sales organization, which showed that he was fully alive to the great financial benefit to be derived from a properly cultivated domestic coke market. Mention had been made by Mr. Jackson of vertical coke being easily lighted with paper and sticks. He (the speaker) could go one better than this; for he was prepared to light horizontal retort coke with paper only.

With regard to the remarks of Mr. Johns and of Dr. Smith, there was no doubt that the maintenance of a constant specific gravity was more important than a slight difference in calorific value. In these matters, it was more or less difficult to say what course should be adopted; but while Mr. Johns' method of restoring inequalities in calorific value was evidently efficacious in his own case, he (Mr. Canning) was personally more in favour of Mr. Kenshole's plan of double charging at the beginning and end of the shift and admitting carburetted water gas in more or less equal proportions throughout the day. There was no doubt that the methods of coke handling employed too often resulted in the production of much dust; and until they could reduce this heavy loss, they would not be able to derive the financial benefit which they should from their coke sales. The point could not be too strongly emphasized that they must begin at the beginning and procure the right coal. Having secured the right coal, and consequently the right coke, they must obtain the right coke handling plants. As to Mr. Johns' suggestion that they might make water gas instead of selling coke, it was evident that Swansea was one of the special cases that were provided for in the paper. There were, he knew, instances to be found in various parts of the country where it was certainly, at the moment, more economical to turn coke into gas than to dispose of it in the domestic market. He purposely said "at the moment," because he was convinced that these conditions would not always exist, and should not in the future be permitted to exist. In the majority of cases, it was perfectly true that it cost more to produce a therm of water gas than a therm of coal gas; but if one could get only (say) 10s. or 12s. 6d. a ton for coke, it was obviously more economical to turn it into water gas—particularly if there was any difficulty in selling the coke, even at the low figures mentioned.

Anything that Dr. Smith told them was worthy of the closest attention; because it was his habit to reflect deeply before he spoke, and so he was not often wrong. He had spoken of the prong cutter as giving a small proportion of dust; and he (the speaker) believed, too, that he knew of screens which reduced dust to a minimum.

COKE IN CUBICAL FORM.

There was one point he would like to stress in connection with screening. He did feel strongly that for domestic use coke of cubical form was greatly to be desired. There were certain screens—such as the bar type—that would give the right size across the minor axis, but on the major axis one could have almost any length. With the mesh type it was also possible to get long pieces of narrow width; and until they had a screen which would give them a cubical coke, he was afraid they would not be able to make any very great progress. Dr. Smith had emphasized the potentialities of the domestic solid fuel market, and had demonstrated that they had only to



INSPECTING A PIT SUPPORT AT THE MARKHAM COLLIERY.

gain a comparatively small proportion of this market in order to get rid of the whole of their coke. The manufacturers, of course, took much of their coke; and while stressing the importance of the domestic market, they must not forget the possibilities of the industrial demand. The importance of a satisfactory tar for roads was obvious; and this subject merited attention, as well as the suitability of coke. At the same time, their tar business was very much more highly organized, and so a satisfactory quality of tar was more easy to achieve. He had, however, in connection with some small gas-works in rural districts, seen crude tar put on the roads; and this was clearly wrong.

With regard to the question asked by Mr. Davey, of course an 8-hour setting was one thing, and a 12-hour setting was another; but the sections and lengths of retorts in which he had worked 12-hour carbonizing were 24 in. by 16 in. by 23 ft. long, and 24 in. by 16 in. by 20 ft. long. Some weeks ago, a certain gentleman connected with the gas industry had expressed the opinion that the subject of coke was being too highly stressed. It was to be expected, however, that coke, as well as gas, tar, and other products, would be discussed as long as the industry continued to exist. Doubtless the subject of coke had been so much mentioned lately because obviously there was apathy, which must be removed.

On the proposition of Mr. KENSHOLE, seconded by Mr. H. D. HAZELL (Newport), Mr. Canning was heartily thanked for his paper.

Before the close of the meeting, a vote of thanks for the use of the room in which it had been held was passed to Captain Phillips (Clerk to the Council), on the motion of Mr. L. MURRAY (Blaina), seconded by Mr. I. G. JENKINS (Abertillery).

The time and place of the next meeting were left to the Council to determine.

LUNCHEON.

The members were the guests at luncheon, in the Castle Hotel, of the Chairman and members of the Tredegar Urban District Council; a party of about 100 sitting down. Mr. W. R. Hopkins was in the chair, and submitted the toast of "The Wales and Monmouthshire District Institution of Gas Engineers and Managers;" remarking that if Mr. Davies did as well for the Institution as he had done for the Council, they would be satisfied. He hoped this would not be the last time that the Institution would visit Tredegar. Councillor S. Filer, in support, also spoke in high terms of the services rendered to the Council by Mr. Davies. He thought the balance-sheet for the past financial year would prove to be one of the best they had ever had. The President, responding, said he wished to take this opportunity of expressing personally his gratitude to the Council for the way in which they had supported him in welcoming the members of the Institution that day. Mr. W. H. Johns and Mr. Octavius Thomas also replied.

The toast of "The Visitors" was submitted by Councillor T. Morgan, Alderman the Rev. A. Barrett, J.P. (Chairman of the Monmouthshire County Council), and Councillor David Griffiths. The response was entrusted to Dr. E. W. Smith and Mr. R. R. Bird. Dr. Smith expressed his gratification at the spirit of optimism which had marked the day's proceedings, and his belief in the tremendous future which lay before the gas industry; while Mr. Bird, in the course of his speech, remarked that "friendship founded on business was better than business founded on friendship."

"The Town and Trade of Tredegar" was proposed by Mr. J. H. Canning, supported by Mr. J. E. Kenshole, and responded to by Mr. W. D. Woolley, J.P. (General Manager of the Tredegar Iron and Coal Company, Ltd.), and Councillors D. W. Bowen and Aneurin Bevan—the keynote of the speeches being the urgent need of close co-operation.

VISIT TO THE MARKHAM COLLIERY.

After lunch, on the invitation of Mr. Woolley, the visitors were taken some four miles down the valley for an inspection of the Markham Colliery of the Tredegar Iron and Coal Company, where tea was provided.

There are two shafts at the colliery, the sinking of which was commenced in 1910 and completed in 1913, to the "Lower Four Feet" or "Old Coal" seam, which is reached at 600 yards. The colliery is electrically equipped throughout. The principal supply is obtained from Oakdale Colliery, 2½ miles to the south, by means of overhead lines. The system is also connected to the Tredegar Collieries, whence current can be obtained. No locomotive is necessary at the colliery, owing to arrangement of gradients. Trucks gravitate through storage siding and screens, and for the pit top are dealt with by rope haulage and gravity. The boxing at the upcast pit is of ferro-concrete.

The seams at present worked are the Big Vein and Upper Rhas Las. The Big Vein seam is generally worked by ordinary stalls. The output at the present time is about 11,000 tons a week. The Upper Rhas Las produces at present about 5000 tons a week entirely on the conveyor system, with mechanical haulages; no horses being employed. In this seam the whole of the face rippings are done by Siscol shearing machines. Hammer picks are also extensively used.

In both seams, owing to the heavy pressure, steel arch roof supports, manufactured by the Tredegar Company, are extensively used. At the present date approximately 14 miles of roadway at the colliery are supported in this way. An Ingersoll Rand cement gun is also in use.

The electrical sub-station was originally in the Big Vein seam, but owing to crush was rebuilt in the Elled seam 16 yards above. It is constructed entirely of specially designed steel arches, which are inverted. They are placed thus owing to the enormous amount of lifting of the floor, whereas the roof is strong. These steel arches are reinforced with wire ropes and embedded in concrete.

GOLF COMPETITION.

The Institution's golf competition was played on Wednesday, on the Tredegar and Rhymney Golf Course. The course is a nine-hole one, and was in excellent condition. In view of the wet and foggy conditions which prevailed, the players are to be congratulated upon their scores. The bogey of the course is 38. Owing to the unavoidable absence of the Secretary, Mr. J. Sadler undertook the organizing duties. The following were the highest scores:

T. B. Walker	93—14—79
R. I. Auckland	85— 5—80
E. I. King	95—14—81
J. S. Burgoyne	97—14—83
W. C. Jackson	91— 6—85

YORKSHIRE JUNIOR GAS ASSOCIATION.

A Meeting of the Association was held at the Griffin Hotel, Leeds, on March 17—Mr. C. H. CHESTER, of Wakefield, presiding. In order to give the younger members an opportunity of taking part in the proceedings, it had been decided to have no report of the discussions on the three papers which were submitted, and of which we give extracts.

MAINS AND SERVICES.

By J. W. HOLROYD, of Elland.

CAST-IRON MAINS.

I will refer first to the ordinary cast-iron socket and spigot pipes with run lead joints. This type of main has been in use for over 100 years, and is "still going strong." It has peculiarities specially suitable for thickly populated districts. It is easy to tap for new supplies, and cast-iron specials of all shapes and sizes are easily obtainable. However, for present-day use it is not by any means the ideal. The heavy traffic of to-day has made the use of cast-iron pipes very dangerous where the mains are laid in the roadway, and the practice of laying mains in such a position is to be deprecated. They should be laid in the footpath. Cast-iron pipes are heavy to handle, and are fragile and rigid. Any settlement of the ground which may occur has to be taken up by the joints. This is all right up to a certain point. After this has been reached, the pipe is fractured. Another disadvantage is that cast-iron pipes are only made in 9 ft. lengths, or at the most 12 ft. lengths. There is no doubt that cast iron becomes porous under certain conditions of the surrounding earth, and in consequence gas leakage occurs. Special attention must be paid to the making of run lead joints. Spigot and socket ends should be thoroughly cleaned before joining up; the yarn used should be of good quality, and should be well driven into position; the lead should be run in so that it fills the joint at one running, and—most important—should not on any account be caulked until the whole of the joint has thoroughly cooled. This is a point often neglected, and is responsible for many of the leaky joints found.

SPUN CAST-IRON MAINS.

Spun cast-iron pipes have many advantages over those vertically cast. The former type is approximately 25 p.ct. thinner, and consequently lighter; and the centrifugal action in manufacture makes it more uniform in thickness, solid in structure, and of a higher tensile strength (being in the neighbourhood of 70 p.ct. stronger). Its density is greater, it is thus less liable to corrosion than the ordinary sand cast pipe. Though spun cast-iron pipes meet the traffic question to a great extent, we still have several of the disadvantages enumerated for the ordinary type—for example, short lengths, giving rise to many joints, each of which, unless properly made, is a potential source of leakage. The spun pipe is not so easily tapped as the ordinary cast, because of its greater density, and there are less threads, owing to the pipe being thinner.

STEEL MAINS.

Steel mains have many advantages. They are incomparably stronger, and, as they are capable of yielding, are practically unbreakable. Consequently they can be laid at less depth, and are suitable for any pressure. They are much lighter to handle, and, being in big lengths, have fewer joints, and therefore fewer chances of leakage. It is easy to adapt them to curves and wide bends, doing away with a number of specials and their joints. For long-distance supply, steel pipes are ideal whether for low or for high pressure gas. It is only when we come to thickly populated districts that difficulties are encountered—e.g., tapping for services. There are two good methods of putting a service into steel mains—namely, the Mueller type of service clamp, and the Woodall and Parkinson expansion nipple. I prefer the former; it is more serviceable.

MAIN LAYING.

In main-laying there are several considerations:

Nature of land (for tools required, &c.).
Fall of land (for syphons, &c.).
Development of the district (for size of main).
Traffic (for vibration).
Possibility of interconnection.

Much inconvenience is caused by:

Mains too small.
No provision for extensions.
Isolated legs and dead ends.

If a main is giving trouble, the first step to take is to fix pressure recorders at three or four points along the track, to record district pressures. From the charts obtained it should be fairly easy to arrive at a decision whether the main is sufficiently large or whether it is a local stoppage. If the latter, the next step is to find the exact location of the main (by pipe locator), and clean the main out or clear it out. Stopped mains should never occur twice.

SERVICE PIPES.

Galvanized and gas tube should not be used. Steam tube is employed largely, but is being displaced by puddled wrought iron. Here let me offer a warning. It is little advantage using puddled wrought-iron pipes and employing specials, such as bends, longscrews, &c., of steam quality. Bends in particular are a great source of trouble and leakage; and to avoid corrosion, only the best should be used. Service pipes should be always on the large side, and take the shortest possible route, avoid bends, and enter the building under ground, if possible.

Generally speaking, every house should have its own service pipe. New housing schemes often offer advantages for the mains to be run through the back gardens, but this is certainly undesirable when the houses do not belong to the local authority. In new housing schemes where the mains are laid in the street, there are numerous cases where costs can be reduced by laying a larger service to supply a block of two or three houses.

Service pipes should be charged up to the tenant or builder. We charge according to the return the service pipe is likely to produce. For instance, if only a cooker is installed, the service pipe is chargeable. In another case, where two gas fires, a gas poker, a gas cooker, and a wash-boiler are being installed in each house, the service pipe is laid free.

SULPHATE OF AMMONIA.

By R. BAKER, of Sheffield.

I propose to deal briefly with one or two of the essentials for economical and efficient working of sulphate of ammonia plant. In the first place, the boilers must be able to cope with heavy steaming duties, and show a high evaporative efficiency. Lime is a heavy charge on sulphate of ammonia. It is poor economy to carry too large a stock, for this depreciates, as will be seen by the following analyses:

—	New Lime.	Old Stock Lime.
	P.Ct.	P.Ct.
Moisture	0·9	35·2
Combined H_2O with organic matter	5·5	15·0
Calcium oxide	87·9	34·3
Calcium carbonate	4·4	14·2
Insoluble matter (mineral)	1·7	1·6
	100·4	100·3

It would be ideal, of course, if just as much lime as is necessary to decompose the "fixed" ammonia could be used. This being impossible, as a margin is required to ensure complete decomposition, a safe minimum must be aimed at. In this connection I might also stress the importance of a close watch on the ammonia content of the effluent, which also must be kept at a minimum. Leakage must be viewed with concern, whether of "gas" or of liquors.

Considering the indirect process of sulphate manufacture, the author dealt first with stills. The essential principle of all stills is to obtain the maximum contact between the steam and the ammoniacal liquor. I have had the opportunity of working four types of still, and find from experience that the more simple the design, the better the efficiency. Some stills are most elaborate, being fitted with intricate trays and bubblers. These usually bring a host of blockage troubles in their train. Other types are built up in simple cascades. This latter class eliminates many blockage troubles; but too great simplicity, while being of untold advantage when the still is used purely as a "free" still, is a disadvantage in regard to the removal of fixed ammonia.

With regard to saturators, the feed of fresh acid should be so regulated as to correspond with the supply of ammonia, which is governed by the supply of ammoniacal liquor to the still. This is ensured by the use of a contrivance which consists of a leaden box with a midfeather drilled diagonally with small holes, into which short lengths of pipes are turned. The number of "pipes" of acid will readily indicate at any given time the amount of acid passing. I have found an acid content between 6 and 10 p.ct. free acid suitable. In some plants intermittent working is practised. I think this method cannot be so satisfactory as continuous working to standard figures. It is advisable to keep strict observation on saturator pressure, and on the temperature of the bath as indicated by the gases leaving the saturator. I have found it advisable to maintain their temperature at 212° Fahr. While this temperature is maintained, any variation in the feed of liquor to the still is shown by the thermometer. An increase or decrease of temperature at this point will indicate respectively a decrease or increase of liquor flow, for a constant supply of "waste gas" is preheating the liquor. Points to be watched are cracks or breaks in the cracker-pipe, escapes through the front of the saturator, and priming of the still.

Ejectors are perhaps the most severely strained units. They are not only subjected to acid action and temperature, but have to suffer abrasion in addition. The steam pipe is the weakest spot; and from experiment, I have found that incorporating it in the body of the ejector, reinforced by enclosed steel rods,

provides for greater durability. The ejector must be robust.

Neutral Sulphate.

I had the pleasure of working with the late Mr. Sheard in an endeavour to make neutral sulphate of ammonia without adulteration. Mr. Sheard patented a device using a water spray on the sulphate in the draining box. This was partially satisfactory; the biggest drawback being the increased amount of mother liquor made. Bedford Gas-Works, I believe, was one of the pioneers of neutral sulphate, their method being heating on iron plates to drive off the moisture after neutralizing. This was satisfactory in some measure, but not applicable to large plant practice. Attempts were then made to condense ammonia from the "free" portion of still, and spray the salt in the centrifuge. This process has its drawbacks in its effect on operatives through pyridine and the influence of ammonia on the copper baskets of the centrifuge. Then came the "Cordite" mixer; soda-ash being added to neutralize the free acid. The soda-ash was detrimental to the quality of the sulphate of ammonia, and consequently ammonium carbonate is now in almost universal use, being the approved neutralizing agent of the Sulphate of Ammonia Federation.

The chemical world at present is somewhat uncertain of the effects of developments in synthetic ammonia and ammonium salts for manurial purposes. Perhaps the most serious threat in this connection is the development of ammoniacal manures such as nitro-chalk, which, it is claimed, are free from the defects, such as land-souring, which are attributed to sulphate of ammonia itself. These manures containing ammonia synthetically produced undoubtedly menace the sulphate of ammonia market, and if costs can be appreciably reduced, bye-product ammonia will become something of a drug on the market, and in those circumstances its conversion to sulphate of ammonia will become unremunerative to the gas industry. This is far from a pleasing prospect. In the meantime, it behoves us to practise every economy and to make every effort to widen our markets, remembering that the small user such as the allotment holder and home gardener must be catered for by provision for the purchase of small quantities at an encouraging figure. Beyond all this, if the worst comes, the gas industry must be prepared to develop processes, like the Burkheiser and the Feld, to deal with crude gas in such a way as to minimize the production of gas liquor.

TAKING A COKE OVEN GAS SUPPLY.

By A. Smalley, of Castleford.

With the time at my disposal, I have no intention of mentioning anything relating to the agreement between our Company and the Yorkshire Coking Chemical Company for the supply of coke oven gas, but intend to give details regarding the laying of the main, together with a brief survey of the conditions obtaining with a total supply of coke oven gas.

It was found that a main 8 in. in diameter would be of ample size to convey the volume of gas likely to be required by us for a considerable time ahead, providing it could be delivered at the inlet of the main at a pressure of about 3 lbs. per sq. in., which pressure, in case of emergency, would be sufficient to force the gas into our holders after purification and registration. This was made possible by the installation of a booster at the coke ovens, capable of working up to 5 lbs. per sq. in. outlet pressure. An 8-in. main was put down, this being of 5 w.g. and of hot rolled weldless steel, with long sleeved patent welded joints, being coated and wrapped in the usual manner, and in lengths varying from 30 to 40 ft. The total length of the main is 2600 yards, or roughly 1½ miles; and inserted in this length are 25 inspection boxes and 7 syphons, placed at distances of 13 to 700 ft. apart. The former length may seem exceedingly small. It is accounted for by reason of an inspection box being placed as near as possible to each bend in the main, as in one instance the road was crossed and the main continued in the same direction on the opposite side. This crossing was on the Castleford boundary line, and was made for two reasons, first to avoid undermining a double tramway track, and secondly to recover about 600 yards of 6-in. cast-iron main previously cut off and left dead. Ordinary cast-iron syphons were used.

The construction of the inspection boxes will no doubt be of interest. A frame 30 in. by 13½ in. was made from 4½ in. by 3 in. by ¼ in. steel angle, and welded to form a 3-in. rectangular flange on the upper side. From the under side of the angle at each end an arc was cut to correspond to the curve of the main, thus enabling the frame to fit on to the main in the form of a saddle. A piece slightly less than that of the framework was cut out of the main, over which the frame was fixed and then welded into position. A steel cover was made to fit the frame, and both were drilled with ½-in. holes for fastening purposes. The cover plate is also fitted with a ¾-in. hole, to which a test pipe is screwed. Seven inspection boxes are situated on the main road, and have been fitted with a heavy type of manhole cover and lid. Owing to dampness round the interior of these chambers and the main, it will be necessary to paint the exposed parts at least once a year. Inspection boxes away from the main road are floated round with pitch, to prevent corrosion. A galvanized wire of 8 gauge runs through the whole length of the main, being looped at each syphon and inspection box, to use for cleaning purposes.

On Oct. 2, 1925, the main was completed, being connected to our exhauster inlet main on that day. Each section of main was tested at 25 lbs. pressure; a portable compressor being used. A final test at the same pressure on the whole length of main was left overnight, and found to be satisfactory. The connections to our exhauster inlet are arranged so that gas may pass through the exhauster or direct into the purifiers should occasion arise. We keep the exhauster running, as it enables a better control to be kept on the gas supply. The outlet pressure of the coke oven booster and the inlet pressure at exhauster are taken each morning, together with the rate of flow of gas; and this gives an idea as to whether any obstruction is forming in the main. Our idea is to tabulate the loss of pressure at varying rates of flow against the theoretical loss at the same rates. So far we have found the actual loss to be slightly in excess of the theoretical one, but following a similar curve on the graph. Pressures are taken along the route at each available point once weekly, and a record is kept, this having recently shown two of the sections to give an increase in pressure. Syphons are pumped weekly with the exception of the one near the coke oven gates, which is pumped by the gas suppliers; and excluding the latter the average quantity of condensate is approximately ten gallons per week taken over the last three months.

Fluctuations were noticed on our inlet chart on one occasion and also on the coke oven chart, pointing to water in the main at some point. All syphons proved to be clear, thus making it difficult to locate the low point, seeing that fluctuations were throughout the whole length of main. The line of main was followed, and near the coke ovens the trench was found to have gone down badly under a heavy weight, due to a 6-ton lorry travelling down the trench line. The lowest point was found, and the main was drilled on the under side; a pipe being led from this into a 3-in. syphon, to save cutting the main. This section was also dragged between the two inspection boxes, and found to be clear.

The main had been in use for our total gas supply for sixteen months up to the end of 1927, and had been used for a part supply for six months; approximately 245 million c.ft. having passed through. We find the pressure thrown at corresponding rates of flow to be slightly higher than when the main was first put into operation. It is necessary to maintain strict observation on this main, for should a stoppage occur, the time taken in locating and clearing it may be of long duration, when the continuation of normal town supply would depend upon the amount of storage, and on any stand-by plant on which could be brought into immediate use. A C.W.G. plant would no doubt be a very good reserve to help out the stocks in case of emergency, but at present our only available plant in this direction is a Tully of 300,000 c.ft. capacity per day. Our holders are kept as full as possible, leaving a reasonable margin for comfortable working. In case of a fall in calorific value on the incoming gas, we can cut off until the standard quality is available.

We have had two stoppages in our supply, both occurring when the demand was at its highest point, and both being in a section of the main controlled by the coke oven people. Fortunately these were not of more than four and six hours' duration. No diluent is added to the gas as received from the coke ovens other than sufficient air for purification purposes. Difficulties in respect of calorific value can only be rectified at the supplier's end. If the lowest point gives a reasonable margin above the required standard, then some means may be adopted to keep a constant value on the town—say, by adding producer gas. In our case this is not applicable. We take our supply of gas over the 24 hours as regularly as possible, but the quantity may be increased or decreased at will, and when a stop is necessary (say) for the repair of a purifier valve, the loss in stock during that period may be soon recovered, providing, of course, purifier capacity will allow the increased rate of flow.

The gas is of a less oily nature than our own gas was; this being proved by the condition of meter leathers. In one case a meter with specially prepared leathers was put out on the district, and after registering 38,000 c.ft. the leathers were found to be dry. This trouble is being overcome by fitting to all new meters (and repairs when possible) the "Certus" oiling device. This keeps the leathers and stuffing boxes in a good condition, as we have proved from a lengthy test. The average composition of the gas, from tests over the last three months, is found to vary as follows:

Carbon dioxide	3·0 to 3·8 p.ct.
Oxygen	0·2 to 0·6 ,,
Carbon monoxide	6·0 to 7·5 ,,
Hydrocarbons	2·4 to 2·8 ,,
Methane	28·0 to 29·4 ,,
Hydrogen	42·6 to 47·2 ,,
Nitrogen	11·1 to 15·0 (by diff.)
Calculated sp. gr.	0·475 to 0·50

In the purified gas the total sulphur content runs between 14 and 20 grains per 100 c.ft. The sulphuretted hydrogen content is mostly between 500 and 550 grains per 100 c.ft., occasionally being as low as 450 and as high as 600 grains. The naphthalene content varies between 2 and 6 grains per 100 c.ft.; and we have adopted oil washing, using our Holmes washer, previously employed for ammonia extraction.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Electrical Fusion of Gas Pipes.

SIR,—"Plus-Minus's" letter in the current issue of the "GAS JOURNAL" raises some very interesting points. I have from time to time made a number of experiments with a view to actually reproducing the conditions under which the fusion of a gas pipe can take place as a result of contact between a pipe and a fault-charged electrical conduit. As a result of these experiments, I am satisfied that the risk of actual fusion varies according to the nature of the contact between the two surfaces. Where the conduit and gas pipe are in thoroughly good connection with each other, as for example where the conduit crosses the pipe and bears down upon it with a considerable degree of force, a large amount of current can pass without actually arcing or melting the compo pipe, and the installation fuses will operate before the temperature at the point of contact is sufficient to melt the pipe. On the other hand, where the nature of the association is very light and just sufficient to establish actual contact, a comparatively small current will result in an arc at that point, and result in a practically instantaneous fusion of the pipe and ignition of the freed gas.

I deliberately refrained from touching upon this point in my booklet, as I did not wish to confuse the main issue with any qualifying factors. My aim was to show that any actual contact between the two services set up a condition of grave danger to the occupiers of the premises. The experience which "Plus-Minus" cites concerning the heating-up of a main cock is indeed interesting, and the first thing that occurs to me is that at what was apparently the rush hour, and with the restaurant full of guests, the proprietor must have had some very definite reason for wishing to turn off the gas at the meter. Had "Plus-Minus" been acquainted with the proprietor's reason for this, I fancy he would have gone a long way towards accounting for the happening. One of the worst characteristics of these matters is the amount of surmise which has to be indulged in in order to account for them. In this case, I should imagine that the blowing of a main fuse interrupted the return of the restaurant current to a legitimately earthed point on the distribution system, but that owing to an improper contact between the two services, the gas supply afforded an alternative path. The only factor that qualifies the excellence of a gas supply system as a conductor of electricity is the presence of red lead at the joints, and it is well known that a dirty joint in an electrical circuit will set up intense local heating at that point, owing to the resistance offered to the flow of the current. In this case, I am of opinion that the presence of red lead in the neighbourhood of the meter cock set up such a resistance, with the result that intense local heating occurred at that point.

I should like to say that I am not only willing, but anxious, to deal with any questions which your readers may care to raise in connection with this subject, either through the hospitality of your columns, or by direct communication with myself, as I feel that ventilation and discussion of this matter presents the only means by which it may be understood and adequately dealt with.

H. C. WIDLAKE, A.M.I.E.E.

Plymouth and Stonehouse Gas Light and Coke Company,
Plymouth,
May 5, 1928.

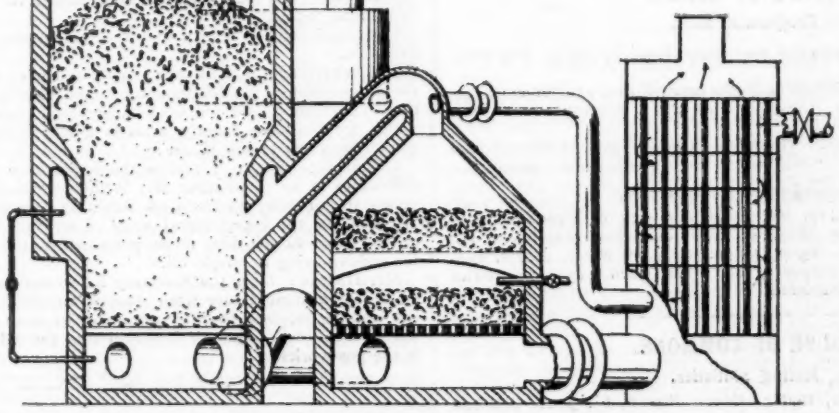
REGISTER OF PATENTS.

Manufacture of Mixed Water Gas and Distillation Gas.—No. 279,060.

HUMPHREYS & GLASGOW, LTD., of Victoria Street, S.W. 1.
(Assignees of C. S. Chrisman, of Philadelphia.)

No. 25,514; Sept. 27, 1927. Convention date: Oct. 13, 1926.

This invention relates to an improved process for the complete gasification of fuels having high amounts of volatile constituents, with the complete recovery of the volatiles and the production of a gas of relatively high calorific power, and free from inerts as compared with the present blue or uncarburetted water gas practice with bituminous fuel.



VERTICAL SECTION OF THE CHRISMAN PLANT.

The invention broadly comprises the sequence of steps which consists in establishing a fuel bed in two divisions, blasting the lower part of each division and storing the heat of the blast gases, upsteaming the whole of one division to make water gas and to liberate distillation gas, such as coal gas, at the top thereof, down-steaming the lower part of the other division, heating the water gas resulting from the down-steaming by means of heat stored during the blasting, passing the heated water gas through the upper part of the upsteamed division along with the water gas generated and the distillation gas evolved therein, and leading off the mixed gas.

Having described the invention in detail, the patentees say that among the advantages realized reference may be made to the following:

The blast gases do not pass through the fuel before it is carbonized and its volatiles driven off. These volatiles are not subjected to a high temperature; and therefore the light oils are recoverable. A large volume of hot blue gas is provided to effect carbonization without recirculating gases through the water gas reaction zone, with consequent dilution of the steam and decrease of capacity. Both up run and down run blue gas pass through the carbonization zones. A gas of relatively high calorific power is produced. The heat of the blast gases is recovered without recourse to a waste heat boiler. Heated secondary air may be provided. Superheated steam may be provided for down-running, or steam may be generated for that purpose. The valves are required to pass only comparatively cool gas, and expensive hot valves are obviated. No gases which have passed through the uncarbonized fuel pass to the atmosphere, obviating smoke nuisance.

The inventors are aware that the division of a fuel bed in a gas generator into two zones is known *per se*, as is the restriction of blasting to the gasification zone. Gas making plant comprising two generators, each with provision for up and down steaming, has also been proposed; and in other plants the superheating of steam in a recuperative chamber and the preheating in supplemental regenerative chambers of air used in the blasting operation are known.

Carburetted Water Gas Apparatus.—No. 282,034.

HUMPHREYS & GLASGOW, LTD, of Victoria Street, S.W. 1.
(Assignees of C. S. Chrisman, of Philadelphia.)

No. 31,280; Nov. 21, 1927. Convention date: Dec. 10, 1926.

The patentees remark that in plants for the manufacture of carburetted water gas the sensible heat in the blast gases is satisfactorily recuperated in a waste heat boiler, and the sensible heat in the down run blue gas is satisfactorily recuperated in the ash at the base of the fuel bed.

The present invention has for its object to provide for satisfactorily

recovering the heat in the carburetted water gas, thus completing the practical recuperation of the sensible heat in all the gases. Other objects of the invention are to provide for discharging only cold gases from the set, to reduce the burden on the condensing apparatus, to cool the gas before passing to the valve at the wash box, and to save generator fuel.

Generally stated, the invention consists in the provision of apparatus for receiving, storing, and subsequently giving up heat, filled with suitable heat-absorbing material and placed at the gas outlet of the superheater of a carburetted water gas set in such a way that gas issuing from the superheater passes through it, storing the sensible heat, and cooling the carburetted water gas prior to its entrance into the wash box, along with the provision of the necessary valves and piping for using the stored heat to preheat air supplied to the set, or to superheat or generate steam for down steaming, or, in short, for heating gas making fluids.

A complete plant is illustrated and described; and it is shown that the "regenerator" is filled with suitable heat-absorbing material, such as clinker, arranged on a shaking grate. The carburetted water gas imparts to this much of its sensible heat, and the comparatively cooled gas passes on to the wash box and thence to the condensing apparatus and for storage or use.

The clinker in the regenerator presents a large surface for its volume, and therefore the regenerator may be comparatively small. The shaking grate is a means for agitating the clinker to prevent its becoming clogged. A depth of three or four feet of clinker may reduce the temperature of the hot carburetted water gas to approximately 500° Fahr.; the permissible reduction of temperature depending upon the temperature at which tar condenses from the gas. The regenerator, besides removing and storing a large part of the sensible heat in the carburetted water gas, reduces the burden on the condensing apparatus, and also protects the reversing valve from excessive heat.

Drying of Gases.—No. 287,678.

Henshaw, D. M., Cooper, C., and Holmes, W. C., & Co., Ltd., all of Huddersfield.

No. 3354; Feb. 5, 1927.

After referring to their previous patents for the partial drying of town gas, the patentees say that investigations have suggested that the removal of a still further proportion of the contained water from fuel gases may in certain cases be desirable; and the object of the present invention is to provide a process for this purpose.

The invention consists broadly in subjecting the fuel gases to treatment with hygroscopic bodies in the liquid state to secure the removal of a proportion of their contained water without reducing the temperature of the gases materially below the locally prevailing temperature, and then subjecting the gases to further treatment for the removal of water with the application of artificial cooling.

Hygroscopic bodies in the liquid state will usually be employed in the second stage of the process; and they will normally be subjected to treatment continuously or periodically to secure the expulsion of the water they have taken up from the gases. This will involve the consumption and subsequent dissipation of heat. If, as is contemplated in the earlier stage of the treatment of the gas, cooling of the same materially below atmospheric temperature is not effected, cooling by artificial means being only resorted to in the later stage, less heat will have to be abtracted and less heat supplied by this relatively more expensive method than if artificial cooling were resorted to during the whole of the treatment of the gases.

Any suitable refrigerating system may be employed for the purpose of securing artificial cooling. Conveniently, an ammonia refrigerating system may be employed; and in this case, as also if a sulphur dioxide refrigerating system is used, the cooling water which has been employed directly for cooling the hygroscopic body may be employed for cooling purposes in the refrigerating plant in order to assist the condensation of the gas which is alternately liquefied and evaporated therein for producing cold.

The invention also extends to the employment of an alternative method of artificial cooling in which two vessels are arranged in communication, one containing a hygroscopic liquid while the other contains water; a reduced pressure being maintained in the apparatus, the evaporation of the water in the one vessel and its absorption by the hygroscopic liquid securing a reduction of temperature of the water-containing vessel. When employing this method of refrigeration, agitation of the hygroscopic liquid and of the water may be resorted to for the purpose of promoting evaporation and absorption.

Evaporation of the water may further, in accordance with the invention, be promoted by admitting air or other gas in a slow stream below the surface of the water, in which case the mixture of water vapour and air or other gas may be bubbled through the hygroscopic liquid to facilitate absorption of the water vapour.

In some cases the hygroscopic liquid employed may be of the same or similar character to the hygroscopic liquid employed in removing water from the gases treated—for example, a concentrated solution of calcium chloride may be employed in the refrigerating system as above defined, a solution of lower concentration being normally used for washing the gas in order to reduce its moisture content. Where, as is usual, hygroscopic materials are employed in both of the stages for removing moisture, the character or composition of the liquids may differ—for example, when a solution of calcium chloride is employed a more concentrated solution may be used in the initial treatment of the gas than is employed in the further treatment thereof. Duplication of the means adapted to reconcentrate the hygroscopic liquids and the storage of the same may in some cases be desirable, although generally the use of a single concentration device will be sufficient. In such case the hygroscopic liquid may be reconcentrated to a degree rendering it particularly suitable for use in the refrigerating operation in which it will become diluted, after which in the diluted state it may be brought into direct contact with the fuel gas in order to effect the removal of water therefrom.

The character of the apparatus employed for bringing the gases into intimate contact with the hygroscopic material in the liquid state may be varied within wide limits.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Progress of Bills.

York Town and Blackwater Gas and Electricity Bill: Reported, with amendments.

South Metropolitan Gas Bill: Reported, with an amendment.

South Suburban Gas (Consolidation) Bill: Referred to a Joint Committee of both Houses.

London County Council (General Powers), and Middlesex and Surrey Thames Bridges Bills: Read a second time, and committed.

Breaking-up of Public Roads.

On Thursday, May 17, the Lord Montagu of Beaulieu is to move: That "the time has come when the whole question of the rights of undertakers to dig up public roads for water, drains, gas, electricity, and similar purposes, and to use such wayleaves free of charge, should be re-considered."

HOUSE OF COMMONS.

Rating Statistics.

Replying, on April 30, to Mr. Ernest Brown, Sir John Gilmour stated that the estimated amount of rates that would be collected for Scotland in 1927-28 in respect of gas undertakings would be £344,000.

Oil Extraction.

Mr. Hardie, on May 1, asked the Secretary for Mines if the oil from the Bergius plant was a synthetic oil; what was the quantity procured per ton; whether the oil had been analyzed, and what were the results; also if the oil differed from that taken from coal by other processes; and was its production likely to be cheaper than present practical and commercially proved plants.

Commodore Douglas King said that synthetic oil was difficult to define accurately, but the oil from the Bergius process was sometimes so described. The answer to the second, third, and fourth parts of the question was that the quantity and nature of the oil produced varied with the coal used; and to the fifth that no information was available at present which would justify a prophecy.

Mr. Whiteley asked the Secretary for Mines the quantities of benzole and liquid fuel manufactured by scientific processes from British coal; and the tonnage of coal utilized for this purpose during 1925, 1926, 1927.

Commodore King replied that the information asked for was not available.

Mr. Whiteley: Has the hon. gentleman noticed that in his speech the Chancellor of the Exchequer referred to this matter as being of great importance, and are we to understand that the information on which we can base exactly what is going to happen in the future cannot be given to the House?

Commodore King: I realize the importance of it. One of my difficulties is as to whether Mr. Whiteley includes in scientific processes the ordinary methods of obtaining benzole from coke ovens. If he means the experimental stage, I am not in a position at the present time to tell him those processes in the experimental stage for endeavouring to obtain oil.

Mr. Hardie: Does the Secretary for Mines call something that is said to be a manufacture from coke an unscientific process, and does the benzole obtained by that process differ from that produced by a scientific process? Has he forgotten that the chief source of benzole is the gas-works?

SOUTH METROPOLITAN GAS BILL.

The Bill promoted by the South Metropolitan Gas Company, the main purposes of which are to extend the limits of supply of the Company and to raise new capital, was before the Unopposed Bills Committee of the House of Lords on Tuesday, May 1, and was ordered to be reported for third reading. There are no substantial amendments since the Bill left the House of Commons, which it has already passed. (The provisions of the Bill, and the proceedings before the House of Commons Committee, were reported in the "Journal" for Jan. 18, p. 151, and March 21, p. 753.)

LLANDUDNO URBAN DISTRICT COUNCIL.

The Unopposed Bills Committee of the House of Lords considered this Bill on Tuesday, May 1, and it awaits report for third reading. It is of an omnibus character, and includes a number of clauses relating to the gas undertaking; these clauses being mainly on model lines (see "Journal" for Jan. 18, p. 151).

YORK TOWN AND BLACKWATER GAS COMPANY'S BILL.

This Bill, the principal objects of which are the conversion and consolidation of the York Town and Blackwater Gas Company's capital, the conferring of further capital and borrowing powers upon the Company, and the establishment of co-partnership, was considered by the Unopposed Bills Committee of the House of Lords on Tuesday, May 1, and was ordered to be reported for third reading.

There have been one or two amendments to the provisions of the Bill as originally introduced (and as set out in the "JOURNAL" for Feb. 1, p. 270). It is now provided that the standard price for gas within the limits of supply (other than that part to which section 34 of the Order of 1924 relates) shall be 15·8d. per therm, or such other price as may be from time to time prescribed by an Order of the Board of Trade under section 1 of the Gas Regulation Act.

The clause, which was reproduced in the "JOURNAL," providing for the substitution of a card index for the shareholders' address book, has been deleted, and the following clause substituted:

> Register of Shareholders and Shareholders' Address Book.—Notwithstanding anything contained in the Companies' Clauses Consolidation Act, 1845, it shall not be obligatory upon the Company (*a*) to keep separately a register of shareholders and shareholders' address book, but in lieu thereof the Company may, if they think fit, keep one register only containing such particulars as are required by the said Act to be entered in the register of shareholders and the shareholders' address book respectively; or
>
> (*b*) to authenticate by the fixing of their common seal or otherwise the register of shareholders or any register which the Company may keep in lieu thereof under the powers of this section.

The fee for special meter readings within the Urban District of Frimley has been reduced from 2s. to 1s., and the price outside that area remains at 2s. 6d., as before.

SHEFFIELD CORPORATION BILL.

Sheffield Gas Company's Petition.

In an Omnibus Bill promoted by the Sheffield Corporation there are some clauses dealing with the admission of waste industrial liquids into the Corporation's sewers, and these were the subject of a petition by the Sheffield Gas Company, who complained that the Corporation were trying to alter the existing law in their favour and to the detriment of the Company.

One clause in the Bill, the Company pointed out, provided for the prohibition, under heavy penalties, of the placing, or knowingly permitting to be placed, or to fall, into any sewer or drain any solid matter, mud, or refuse except as is contained in ordinary house sewage, and proposed to give power to the Corporation's officers to enter premises and examine whether the provisions of the clause were being contravened.

Another clause provided for the prohibition, under heavy penalties, of the discharge into any sewer of the Corporation or into any sewer or drain communicating therewith of (*a*) any chemical, or manufacturing, or trade, or other liquid refuse; (*b*) any waste steam condensing water, heated water, or other liquid of a higher temperature than 110° Fahr., which, either alone or in combination with other matter or liquid in a sewer, might cause a nuisance or involve danger or risk of injury to the health of persons entering the sewers, or be injurious to the structure or materials of the sewers, or interfere with the purification of the sewage, or tend to produce an effluent injurious to agriculture if used for agricultural purposes; or (*c*) any crude petroleum oil or other products of petroleum and mixtures containing petroleum which give off an inflammable vapour at a temperature of less than 73° Fahr.

It was also proposed to give the Corporation power to construct inspection chambers in manufacturing premises for the purpose of ascertaining the nature of the discharge from such premises into the sewers.

The Company objected to the Corporation being granted powers by which they would be injuriously affected and under which the Company's property might be entered upon and compulsorily used and interfered with.

It was pointed out that, under the provisions of the Public Health Act, 1875, the Rivers Pollution Prevention Act, 1876, and the West Riding of Yorkshire Rivers Act, 1894, it was obligatory upon the local authority to receive the sewage and liquid from factories into their sewers, though it might be an offence for the local authority to discharge such sewage and liquid into streams, thereby imposing a duty on the local authority, if need be, to purify such sewage so as to make it fit to discharge into streams. The provisions of the Acts of 1875 and 1876 had been varied subsequently, but it was still the lawful right of manufacturers to discharge sewage from their factories and works into the sewers of the local authority, provided that the sewage thereby discharged was not of itself or in combination with other sewage a nuisance or danger or injurious either to health or to the structure of the sewers.

In seeking to alter the general law in their favour, and to prohibit the discharge into their sewers of any solid matter, mud, or refuse except such as was contained in ordinary house sewage, the Corporation were attempting to differentiate between household sewage and sewage from factories and works. This was a new departure from the general law, and one that was aimed directly at manufacturers such as the Gas Company. Further, the word "mud," the Company were advised, might include particles of matter in suspension, which, under the existing law, were by no means necessarily prohibited from being passed into sewers. The proposed variation in the existing law would in effect deprive the Company of the rights they had hitherto enjoyed in disposing of their sewage, and would impose on them the great expense of providing extensive plant in their own premises to filter and purify the sewage. They would thus be burdened with the double expense of treating their own sewage and contributing in their rates to the purification and filtration plant of the Corporation, which latter should be adequate and should have been so constructed as to deal with the sewage from the gas-works.

The proposal to prohibit waste products which would interfere with the purification of the sewage or tend to produce an effluent injurious to agriculture, if used for agricultural purposes, suggested to the Company that the Corporation were contemplating carrying out a new method of sewage disposal different from the one at present employed. The present method of sewage disposal had been in operation for many years and had satisfactorily dealt with the sewage of the gas-works, and the Company objected to any new method being put into operation which would prejudicially affect them and the rights they had for so many years enjoyed of discharging the sewage from their works into the Corporation sewers.

It was also submitted that whenever any sample of sewage passing from the gas-works into the Corporation sewers was taken by an officer of the Corporation, a portion should also be handed to the Company, for separate analysis, if desired.

The Company also objected to the expenditure of public money on the construction of inspection chambers in manufacturing premises, and submitted that such expenditure would be entirely wasteful and unnecessary. No sufficient case had been made by the Corporation to show that facilities were not already readily given by manufacturers generally to Corporation officials to inspect and ascertain the nature of the discharge from their premises into the sewers; and the existing law gave the Corporation very wide and ample powers in this respect. Even were this not so, the Company would still object to the Corporation being given power to interfere with their works, and, without permission and without payment of compensation, to enter upon their premises and construct permanent works there, though such works and their position and design might be most prejudicial to the Company and to the efficient conduct of their business.

A clause for the protection of the Gas Company has been agreed upon with the Corporation, and has been inserted in the Bill. It is as follows:

> For the protection of the Sheffield Gas Company (in this section referred to as the "Company") the following provisions shall, unless otherwise agreed in writing between the Company and the Corporation, have effect (that is to say):
>
> (1) Notwithstanding anything contained in the sections of this Act of which the marginal notes are "Regulating discharge of solid matter and refuse into sewers," and "Regulating discharge of offensive liquids into sewers," the Company may discharge in a regular and continuous flow the spent gas liquor produced at their gas-works from the coal distilled thereat by the Company. Provided that all such liquor shall be free from all soluble sulphides, and prior to such discharge shall be settled in tanks of sufficient capacity to remove suspended solids.
>
> (2) Any samples of effluent taken on behalf of the Corporation from any inspection chamber constructed on the premises of the Company under the section of this Act of which the marginal note is "Power to construct inspection chambers in manufacturing premises," shall be taken in duplicate, and one of such samples shall be left with the Company.

WEALD ELECTRICITY SUPPLY BILL.

Transfer of Electricity Powers of a Gas and Electricity Undertaking.

The Unopposed Committee of the House of Lords, on Tuesday, May 1, ordered this Bill to be reported for third reading. The purposes of the Bill are to authorize the Weald Electricity Supply Company, Ltd., to purchase the electricity part of the undertaking of the Crowborough District Gas and Electricity Company, by agreement, to extend the area of supply of the Weald Company, to include the electricity area of the Crowborough Company, and to empower the Crowborough Company to raise further capital.

It is stated in the preamble that the Weald Company have applied to the Electricity Commissioners for a Special Order to extend their area for the supply of electricity so as to include several parishes adjacent to the area of supply of the Crowborough Company, and the two Companies have agreed upon the purchase by the Weald Company of the electricity part of the Crowborough Company's undertaking for the sum of £32,000 and such further sums as the Auditors of the Crowborough Company may certify to have been expended by the latter Company, and properly chargeable to capital, between Dec. 31, 1926, and Sept. 30, 1927 (the latter being the date of the agreement).

There are provisions in the Bill for the confirmation of the agreement, for the winding-up, by the Crowborough Company, of the electricity part of their undertaking, and for the repeal of the relevant parts of the Crowborough Company's Acts and Order. General powers are conferred upon the Weald Company with regard to electricity supply.

There is a clause providing for the application of the purchase money by the Crowborough Company. This provides that the money shall be applied (1) in paying off the £8000 debentures of the Company outstanding at the date of the passing of the Act; (2) in paying off the £5000 8 p.ct. redeemable preference stock outstanding at the passing of the Act and repayable on or before Dec. 31, 1930; (3) in paying off the £5000 7 p.ct. redeemable preference stock outstanding at the passing of the Act, and repayable on or before Dec. 31, 1930; and (4) in paying off the £14,500 debenture stock outstanding at the passing of the Act, and repayable on or before Dec. 31, 1932.

In another part of the Bill power is given to the Crowborough Com-

pany to raise additional capital to the extent of £31,000 by the creation and issue of new consolidated ordinary stock and/or new preference stock. The new stock is to be sold by auction or tender. The dividends of the Crowborough Company on the new capital are limited to 5 p.ct. on the ordinary and 7 p.ct. on the preference, unless larger dividends be at any time necessary to make up a deficiency of any previous dividend on any portion of the ordinary capital below the 5 p.ct. There is power to borrow up to half the issued capital. Another clause provides that the Crowborough Company, after having paid off the £8000 debentures and having paid or invested the moneys payable in respect of the £14,500 debenture stock already mentioned, may borrow on mortgage, or raise by debentures or debenture stock, any sum not exceeding £17,500.

After the transfer of the electricity part of the undertaking, the name of the Crowborough Company is to be the Crowborough District Gas Company.

The agreement entered into by the two Companies is scheduled to the Bill, and, after setting out the payment to be made to the Crowborough Company for their electricity undertaking, it provides also that the Weald Company shall purchase such quantity of loose electricity plant and effects of the Crowborough Company in stock at the date of the agreement and not included in the capital expenditure.

LEGAL INTELLIGENCE.

JOHN WRIGHT AND EAGLE RANGE COMPANY, LTD., v. GENERAL GAS APPLIANCES, LTD.

An Action for Infringement.

In the Chancery Division of the High Courts on Wednesday, May 2, the hearing was commenced before Mr. Justice Maughan of an action in which John Wright and Eagle Range, Ltd., of Essex Works, Aston, Birmingham, sued General Gas Appliances, Ltd., of Corporation Road, Guide Bridge, Manchester, for an injunction as follows: To restrain the defendants, their agents, and servants from infringing the plaintiff's letters patent No. 18995, of Aug. 21, 1913, and from manufacturing, selling, or exporting for sale any articles constructed in infringement of the said letters patent, and for an inquiry as to damages with delivery up of the infringing articles.

Counsel appearing for the parties were: Sir Duncan Kerly, K.C., and Mr. Trevor Watson for the plaintiffs; and Mr. Swan for the defendants.

Sir Duncan Kerly, opening the case, explained that his clients had been, for many years, among the foremost manufacturers of gas stoves in this country. Several years ago, in common with many other manufacturers, they pooled their interests, and formed Radiation, Ltd.; but plaintiffs remained a separate corporation, and were still the owners of the patent in question in the action.

Defendants were a competitive company, and their defence was the usual defence in actions of this character. They raised the issue that the patent was an invalid one on various grounds, and principally on the ground that it had been anticipated. On the question of infringement, defendants denied that they had infringed any of the plaintiffs' patents, though he could not see that this was really a serious issue. The defendants had undoubtedly introduced into the stoves they manufactured the patent owned by the plaintiffs; and as the defendants had alleged that there was no patent in the plaintiffs' stove, he asked them why they copied it. Counsel then traced the history of the gas stove in general and its development, and remarked that the plaintiffs had had first-rate advice in the course of their improvements in stoves from the year 1900 down to 1913.

The products of combustion must be kept from the room: and this the plaintiffs' design effected. The need for a clear blue flame was recognized, with the heating of something incombustible to incandescence. The patent provided a second passage for air into the chimney, entering just below the stove canopy, which served the purpose of promoting greater ventilation of the room. Thus there was a pair of flue passages—the combustion products flue and the ventilating passage. The latter, with inlet at the front and top, was arranged by dimensions and position to allow an inflow of air caused by the heated product of combustion.

Counsel said the invention was exceedingly simple and effective, and its advantages were surprising. Sales had been enormous. Until the war came along, plaintiffs had sold 28,000 stoves. Since the war there had been a large and steadily increasing demand and sale. In 1921 the number sold was 16,000; in 1922, 23,000; in 1923, 28,000; in 1924, 41,000; in 1925, 42,000; and in 1926, 47,000.

His contention on the whole case was that, if the patent was valid, the defendants had infringed it, because theirs was what was known as a "Chinese copy." However, as he had said, there really was no question of infringement; the question was one of validity. Defendants pleaded certain technical articles published before 1913 as being evidence in support of their plea of anticipation. To succeed on that particular plea, the defendants must show that it was evident that the whole invention had been shown, and also prove a practical application in some way; but they had done nothing of the kind. Defendants had quoted alleged prior patents, such as one in U.S.A., No. 417,765, of 1885 (Wright), and technical articles, which mentioned a catalogue of the Davis Gas Stove Company, Ltd., of 1912 (which was now one of the plaintiffs' group); and they said that the Ashton Gas Company, of Ashton-under-Lyne, purchased from the Davis Gas Company, and installed, certain gas stoves fitted with a double canopy and a pair of outlet apertures for the fire to the chimney in 1911, 1912, and 1913. In 1911, they said, the British Gas Light Company, of Hull, supplied in Hull seven and ten pillar "Apollo" fires; while the Barnsley Gas Company, in 1913, purchased and installed a No. 3 "Apollo" stove obtained from the Davis Gas Company. Defendants also said that the patent was not useful, and did not give more ample and successful ventilation.

Counsel emphasized that the plaintiffs' patent actually carried out the work for which it was designed, and, therefore, served a very valuable purpose, that made the stove a great success. If there was anticipation in the "Apollo" stove, it was accidental.

Thursday, May 3.

Mr. *Hubert A. Gill*, M.A., Chartered Patent Agent and Consulting Engineer, said he had made himself acquainted with the general conditions relating to the use of gas fires, and in particular the problems involved in the plaintiff Company's specifications. The necessary steps in the patent were (1) to get away the products of combustion, (2) the ventilation of the room, and (3) the radiating efficiency of the stove. The plaintiffs' fire was a very useful one, and the invention had not been cited in the documents said to contain anticipation, and put forward by defendants in this action.

Mr. Trevor Watson said that the Wright "U.S." stove was invented by the father of the founder of the plaintiff Company, and this accounted for its early date.

Witness said that the technical articles contained in a journal, and referred to by the defendants, contained nothing new in the way of a gas fire, but suggested a fitter's job. It related, in his opinion, to a gas fire that stood out into a room. Defendants had cited a number of patents as anticipating the plaintiffs'.

In cross-examination, witness did not agree that the problem of ventilation through the canopy of a closely fitting stove was understood prior to plaintiffs' patent.

Mr. Swan: Webber, in his patent, points out the virtue of a gap between the canopies for ventilating purposes.

Witness replied that that patent was produced in a stove that was unsightly and had little sale. The plaintiff's patent, however, constituted a successful attack on the problem of combustion and withdrawal of cold air from a room.

Friday, May 4.

Prof. *Wm. Arthur Bone*, of the Imperial College of Science and Technology, and formerly of the Leeds University, said that since he went to the Leeds University in 1906 he had been studying, from the scientific point of view, the use of gas for heating purposes, and in particular for the heating of living rooms, and the construction of gas fires. In 1909 a report was made to The Institution of Gas Engineers as to the radiant efficiency of the then existing gas fire. They found with the gas fire of that period, working under normal conditions, that of the radiant heat about one-third went into the room, one-third up the chimney and was lost, and the other third got into the room by convection. The attention of the gas industry was drawn to the consideration of the comparatively low radiant efficiency of the then gas fire.

Sir Duncan: Did makers take up the matter, and try to improve the stove?—The effect was that the gas fire makers began to engage scientifically-trained men (and the first two engaged came from the Leeds University) to assist them. Messrs. John Wright took one, and another firm the second. They realized that heat by radiation was preferable to heat by convection.

Counsel: At that time was attention directed to the ventilation of the room?—Not ventilation *per se*. The chief object was to prevent the products of combustion getting into the room. It was at first thought that if you got additional ventilation, you would have to pay dearly for it.

Continuing, witness said that investigation of the ventilation problem was continued, and a Committee still continued its investigations. It was not till about 1913 that they began particularly to look into the subject of ventilation.

Sir Duncan: What was the effect of the improvements made by the stove of 1913?—The radiant efficiency was certainly improved by between 40 and 50 p.ct. By their stove, the plaintiffs secured designs which prevented the products of combustion getting into the room, and they began to enlarge their flues, which, up to this time, were comparatively small, and to get better ventilation as well.

Witness added that rapid advances were made between 1900 and 1913. The "Wizard" stove was one of the best about that time.

Sir Duncan: Does the apparatus described in the patent in this case offer advantages over any known form of gas fire known to you before this date?—Yes.

Will you tell us the advantages?—Yates had this problem to solve. He wanted to construct a self-contained gas fire which would fit into the then existing coal fire place, and which would have a high radiant efficiency and a high ventilating capacity, and would not draw the greater part of the ventilating air over the radiants, so reducing their temperature. In the "Vandyke" stove is a contrivance which is foolproof, and provides adequate chimney draught. It will ventilate well, has a high radiant efficiency, and will prevent the products of combustion getting into the room. The other advantage is that the flues provide for two streams of air going into the chimney in the products flue, and an uncontaminated stream of air passing in as well; and the effect of this is that it permits the escape of any contaminated air. I regard that as a very important invention. Witness did not think the technical articles that defendants relied on contained any anticipation of plaintiffs' patent.

Sir Duncan: Did any of these publications, so far as you are aware, lead to any advances in the direction of the plaintiffs' invention?—Not so far as I am aware.

The hearing was adjourned.

MISCELLANEOUS NEWS.

GAS v. ELECTRICITY AT ROTHERHAM.

The rivalry for business between the Gas Department and the Electricity Department was the subject of discussion at a recent meeting of the Rotherham Council. The minutes of the Electricity Committee recommended an application to the Electricity Commissioners for sanction to the borrowing of £40,000 to cover the cost of installations and purchase of slot meters in connection with the assisted wiring scheme during the next three years.

Councillor HALL thought it should be made plain as to the cost to consumers. Some people who were having electric light installed had the impression that when they had paid for it they would then pay about the same as those who were charged on rateable value.

Councillor DICKINSON proposed the reference back of the recommendation, and that a Sub-Committee composed of members of the Electricity and Gas Committees be appointed with the object of seeing if some working arrangement between the two Departments was not possible. It would be interesting to watch the progress of the battle between the two Departments if nobody else was suffering, but unfortunately the ratepayer stood to suffer inasmuch as the ratepayers' capital already invested in the gas-works was being damaged by stopping the consumption of gas for illuminating purposes. The houses now being dealt with were fitted with gas, and, generally speaking, the consumers were satisfied. It was only through the energies of canvassers that they were being induced to change; and little did they know what they were letting themselves in for in the matter of cost. If these two Departments were to be regarded as rivals, then they must in fairness be put on the same footing. There should be no "free" public lighting which cost the Gas Department nearly £3000 per annum; and instead of gas profits being applied to the relief of the rates, the full benefit should be given to the consumers in the form of lower charges.

Councillor CRUIKSHANKS, in seconding, regarded it as unfortunate that municipally they should have two competing Departments.

Alderman GUMMER, supporting the amendment from the standpoints of the consumer and the landlord, said he had had his attention called to the agreement which, if a landlord signed, prevented him from re-letting a house until the tenant who was going in agreed to use electricity. He never knew a more unfair method of obtaining trade than to suggest that a landlord should sign such an agreement. The consumer had to take 800 units spread over a period.

The amendment to refer back the minute was carried.

GAS EXHIBITION AT BUXTON.

Happy Cookery by Gas.

"Domestic happiness, we are told, depends upon one's digestion, but surely 'happy cookery'—that is, of course, gas cookery, with its cleanliness, easy management, and efficiency—must play an important part," said the Mayoress of Buxton (Mrs. J. J. E. Pugh) in opening a gas exhibition and practical cookery demonstration organized by the Buxton Municipal Gas Department at the Gas Service Buildings, Higher Buxton. Mrs. Pugh went on to say that a thousand additional gas cookers had been installed in Buxton during the last five years; and the improvements in cookers, lamps, and heaters had made them thoroughly artistic. She wished to express her appreciation of the courtesy and prompt attention which Mr. Shaw, their respected Gas Engineer, and his staff gave at all times. Mr. Shaw, in thanking the Mayoress for her kind references to himself and his staff, said they always tried to give satisfaction to the public. As Mrs. Pugh had said, great improvements had been made in gas cookers and other appliances; the new all-enamel cooker being a triumph.

Lectures and demonstrations in gas cooking were given by Miss H. H. Tuxford, M.C.A., and were largely attended. The exhibition was one of the most successful held in Buxton.

TRADE NOTES.

"Cascade" Tar Plants.

Messrs. Clayton, Son, & Co., Ltd., of Leeds, have recently completed installations of the "Cascade" system of tar dehydration to the orders of the Primitiva Gas Company of Buenos Aires, Ltd., and the Ely Gas and Electricity Company, Ltd. These plants have daily capacities of 20 and 10 tons respectively. Further plants are at present under construction for Messrs. Road Products, Ltd., of Buxton, and the Fraserburgh Town Council Gas Department.

The Singapore Floating Dock.

From among the hundreds of protective coatings available, "Bitumastic" specialities have been selected to protect an important Government structure against corrosion. Messrs. Wailes Dove Bitumastic, Ltd., the sole makers of all "Bitumastic" protective coatings, have been granted permission by the Admiralty to make it known that their materials have been applied to the new Singapore Floating Dock. Built by Messrs. Swan, Hunter, & Wigham Richardson, Ltd., at their Wallsend-on-Tyne yard, this huge dock measures 885 ft. long, 172 ft. wide, and 75 ft. deep, and has a lifting capacity of 50,000 tons. The fact that this dock will be situated at Singapore will mean that "Bitumastic" coatings will be subjected to very severe conditions; but past experience has proved that Messrs. Wailes Dove's specialities are capable of maintaining the high standard for which their name is world-famous.

COAL TRADE REPORTS.

From Our Own Correspondents.

NORTH-EAST COAST.

A weaker tone has come into the market during the past week, and many collieries are short of trade for the immediate future. Generally speaking, quotations are being maintained at recent levels; but business has been slow, and there has been more idle time. It is hoped that benefit will be forthcoming from the increase in German internal prices, which has been necessitated by the higher wages rates, though German export prices appear likely to remain unchanged. Any additional demand for English coal to North Germany would greatly help this market.

Demand for gas coals has been quiet, though quotations are maintained at 15s. 6d. to 16s. for Wear Specials, 15s. for best qualities, and about 13s. 3d. to 13s. 9d. for seconds. Coking coals are easy and are quoted at 13s. 3d. to 13s. 6d., with very little trade passing. Durham unscreened steams are now no better than 14s. 6d. for best makes, with seconds nominally 13s. 6d. to 13s. 9d., but in plentiful supply. Northumberland steams remain quoted at fixed prices, from 13s. 6d. for best screened sorts downwards, but only D.C.B. qualities are at all well placed. The coke market is slack, and gas makes are no better than 19s. to 19s. 3d. f.o.b. for shipment.

YORKSHIRE AND LANCASHIRE.

Gas coals in Yorkshire and Lancashire are moving in accordance with contracts, there being a slight increase in values in respect of forward deliveries.

Industrial fuels are spasmodic, the situation varying according to the position at each supplying colliery.

The Five Counties Marketing Scheme in respect of export for the time being rules the market.

The domestic trade during the past week has ruled on the quiet side, with indications of slightly increased values from South Yorkshire.

MIDLANDS.

Since the opening of May the coal trade in the Midlands has been in a queer position. Collieries in the Five Counties Scheme have notified advances all round, amounting on the average to about 1s. 6d. While the market is not over-supplied, as it was prior to the restriction of output under the quota decree, there is no shortage in a general sense. Only in very special cases therefore have buyers conceded the higher rates demanded.

Faced with the alternative of losing the business, collieries did not invariably insist on the advance. At the outset unassociated collieries made no change in their quotations. Apprehensions lest they should take the opportunity of following the lead to an extent which would still give them priority would have imparted a firmer tendency to the market but for the backwardness of demand.

Merchants say there is no possibility of getting enhanced prices out of householders at this season of the year. The industrial demand is weak. At present the big consumers are pretty well covered. The real trial of strength may therefore be postponed for a time. It is believed in the inland trade that the increase of the quota from 65 to 67½ p.ct. would not have been made but for the outcry of the Humber exporters.

With a considerable number of collieries free to make the best output they can, big consuming districts like that of which Birmingham is the centre are unperturbed by announcements of higher prices, and little movement has resulted.

Blast-furnace coke is still obtainable round 12s. at the ovens.

Gas in a Heysham Housing Scheme.—The new London Midland and Scottish Railway Company's improved steamship service to Belfast, which has been transferred from Fleetwood to Heysham, commenced on April 30. Heysham Harbour now being the main L.M.S. port for the north of Ireland service, the Railway Company have had to provide accommodation for their employees transferred from other centres. In connection with this, an accommodation scheme commencing with seventy houses has been started at Heysham. The Morecambe Corporation, through their Gas Engineer (Mr. T. W. Barratt), have secured an order for the supply and fixing of three gas fire mantel registers and a wash-boiler in each house, while the Gas Department are providing a gas cooker with each prepayment installation. It is also interesting to know that the Morecambe Corporation are shortly absorbing Heysham into the borough, which, it is suggested, is to be called the Borough of Morecambe-Heysham.

Gas Stoves in Old Buildings.—The Public Health Committee of the London County Council report that they have considered a suggestion made when the draft by-laws as to houses let in lodgings were under consideration, and also put forward by the Society of Medical Officers of Health (Metropolitan Branch), that legislation should be introduced to enable sanitary authorities to deal with the fixing and user of gas stoves in old buildings, in order to secure necessary health requirements. The matter has been discussed with officers of the Ministry of Health and the Board of Trade, and with the gas companies in London. A Joint Committee of the two Government Departments have had the matters under consideration for some time, and valuable practical and experimental work is being done by the companies. In all the circumstances, the Committee have decided that at present new legislation is not required; but they propose to keep in close touch with the work being done and inquiries made by the Government Departments and the gas companies.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *May 7.*

Pitch is quiet, and little business is reported. The price is steady at not below 65s. per ton f.o.b. makers' works.

Creosote is about 8¾d. to 8¼d. per gallon.

Pure benzole is 1s. 8d. to 1s. 9d. per gallon, pure toluole about 2s. 2d. to 2s. 3d. per gallon, and 95/100 solvent naphtha about 1s. 7d. per gallon.

Pyridine is 5s. 3d. to 5s. 6d. per gallon.

Tar Products in the Provinces.

May 7.

Markets for tar products are still quiet.

In pitch, there is little or no business doing, and no pressure whatever to sell.

Creosote oil is quiet both for home and export.

Water-white products are steady but in a little uncertainty as to exactly what will be the effect of the remission of the kerosene tax.

Crude carbolic remains firm, and business is reported for delivery to the end of the year.

Cresylic acid is steady. The best qualities are still in good demand; but it is not quite so easy to sell the inferior grades.

Naphthalene is still firm. There is a fair amount of inquiry; but buyers are resisting the advanced prices.

There are several inquiries for hot pressed naphtha.

Pyridine is entirely neglected, and the price is purely nominal at 5s. per gallon.

The average prices of gas-works products during the week were: Gas-works tar, 45s. 3d. to 50s. 3d. Pitch—East Coast, 62s. 6d. to 65s. f.o.b. West Coast—Manchester, 60s. to 62s. 6d.; Liverpool, 62s. 6d. to 65s.; Clyde, 65s. to 67s. 6d. Toluole, naked, North, 1s. 3d. to 1s. 4d. nominal. Coal-tar crude naphtha, in bulk, North, 7½d. to 8d. Solvent naphtha, naked, North, 8¾d. to 9½d. Heavy naphtha, North, 8¾d. to 9¼d. Creosote, in bulk, North, liquid, 6¾d. to 7d.; salty, 6¾d. to 6¾d.; Scotland, 6¾d. to 7d. Heavy oils, in bulk, North, 8¾d. to 9¼d. Carbolic acid, 60 p.ct., 2s. 3d. to 2s. 4d. prompt. Naphthalene, £13 to £15; salts, £5 to £5 10s., bags included. Anthracene, "B" quality, 2¼d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

Benzole Prices.

The following are considered to be the market prices to-day:

	s. d.	s. d.	
Crude benzole . . .	0 10½	to 0 11	per gallon at works
Motor ,, . . .	1 4½	,, 1 5	,, ,, ,,
90 p.ct. ,, . . .	1 5½	,, 1 6	,, ,, ,,
Pure ,, . . .	1 9	,, 1 10	,, ,, ,,

The Chalk Fuel Case.—The name of Sir Charles Buckworth Herne Soame, Bart., formerly of Wellington and Dawley, Shropshire, has been ordered by the Committee constituted under the Solicitors' Acts to be struck off the Roll of Solicitors. The Committee found that he had been guilty of misconduct in respect of matters for which he was convicted at the Central Criminal Court of conspiracy to defraud.

Superannuation and Co-Partnership at Swansea.—The annual general meetings of the superannuation scheme and of the co-partnership scheme of the Swansea Gas Light Company were held on April 17 at the Gas-Works, Oystermouth Road. Mr. Ernest Leeder (Chairman of the Company), who presided, said that the amount paid out to pensioners during the year was £588, which was roughly £166 more than during the previous year. With regard to the co-partnership scheme, the Directors had been able to allocate £2250—the highest amount since the inauguration of the fund.

CONTRACTS OPEN.

Coal.

The Gas Committee of the City of Stoke-on-Trent invite tenders for the supply of gas fuel. [See advert. on p. 407.]

The Lisburn (Co. Antrim) Gas Department invite tenders for the supply of gas coal. [See advert. on p. 407.]

The Skipton Gas Department invite tenders for the supply of coal. [See advert. on p. 407.]

The Teignmouth Urban District Council invite tenders for the supply of gas coal. [See advert. on p. 407.]

General Stores, Lead, Lead Wool, &c.

The Gas Committee of the City of Leeds invite tenders for the supply of various stores. [See advert. on p. 407.]

Lamps, Fittings, &c.

The Gas Committee of the City of Leeds invite tenders for the above. [See advert on p. 407.]

Pipes, &c.

The Gas Committee of the City of Leeds invite tenders for cast iron pipes and wrought iron tubes and fittings. [See advert. on p. 407.]

Retorts.

The Gas Department of the Borough of Pontefract invite tenders for the renewal of two beds of retorts. [See advert. on p. 406.]

New Holder for Bathgate.—The Bathgate Dean of Guild Court, who have had three sittings considering the plans of the Bathgate Gas Company, Ltd., for the erection of a new gasholder, have now intimated approval. Objections to the erection were made on behalf of two conterminous proprietors, but these were rejected. The gasholder will be a two-lift spiral one, capacity 300,000 c.ft.

The price of gas at Elsecar, Hoyland, and Wentworth has been reduced to 4s. per 1000 c.ft.

Application is to be made by the Blackpool Corporation for a loan of £24,000 for gas mains.

At Sheffield, William Cunningham was sentenced to one month's imprisonment with hard labour on a charge of stealing 12s. 10d. from a gas meter at his residence.

A verdict of suicide while of unsound mind was recorded at the inquest at Burwash, Sussex, on Herbert Taylor, owner of a local gas-works, whose body was found on the railway.

The Whessoe Foundry and Engineering Company, Ltd., of Darlington, announce an increased dividend of 12½ p.ct. for the year ended March 31 last. For each of the three preceding years the Company paid 10 p.ct.

The laying of a main from the Preston Gas Company's new works at Lostock Hall to Fishergate Hill is proceeding. The main, which is of cast-iron, has a diameter of 30 in. The estimated cost of laying the pipeline is £30,000.

A gas explosion which occurred at a house in Gwendoline Street, Liverpool, recently wrecked two rooms. A sub-tenant had disconnected a gas chandelier from the ceiling, and this had caused a fracture of the pipe, which resulted in an escape of gas.

The gas distribution returns of the Accrington District Gas Board for the year just ended show that the gas appliances disposed of in the showroom numbered 1879, consisting of: Cookers, 1047; fires, 329; wash-boilers, 474; grillers, &c., 13; and water heaters, 16.

The Bradford Tramways Committee propose to purchase from the Gas Committee 4830 sq. yards of land, forming the site of the disused gas-works at Ludlan Street, at the price of £2500, for use as a central garage for the motor 'buses owned by the Tramways Department. The Gas Committee are prepared to sell at that price.

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STOCK MARKET REPORT.

DESPITE the enormous activity in Industrial shares and the eagerness to secure high-yielding loans, there was a rush of applications for the cash issue of the 4½ p.ct. New Zealand stock. At the price (94½ p.ct.), the yield, after allowing for the value of redemption, was slightly under 5 p.ct., yet the quotation with extensive "stag" selling went to 12s. 6d. premium. It is clear, therefore, that there is a large number of investors who prefer a low return combined with safety. An event of interest during the week was the announcement of Hambros Bank to allot a share-for-share bonus, in addition to the usual dividend, by the capitalization of £400,000 of the contingency reserve account.

The various trust companies were still in the market for Gas Stocks, and directors of companies requiring additional capital would be well advised to take advantage of the present demand. The Tottenham and District Light Company offer £155,875 redeemable debenture stock at £96 10s. per £100, the yield on which is £5 3s. 7d. p.ct., excluding profit on redemption. There was another remarkable rise (7 points) in Imperial Continental ordinary. The quotation is now 167-172, as compared with 145-148 three months ago. The Maidstone 5 p.ct. capital stock was sold at 115 during the week; and we feel we must again draw attention to the low quotation of 109-112, which is much below its true value.

The following transactions were recorded during the week:

On Monday, Brighton and Hove 5 p.ct. 106, Continental Union 7 p.ct. preference 93, Gas Light and Coke 18s. 7¼d., 18s. 9d., 18s. 10½d., 18s. 11¼d., 19s., 4 p.ct. preference 79, Imperial Continental 162, 163½, 164, 165, 166, North Middlesex 6 p.ct. 99½, Primitiva 27s. 6d., 27s. 7¼d., 27s. 9d., 27s. 10¼d., 28s., 28s. 0¾d., 28s. 1¼d., 28s. 3d., 4 p.ct. 1st debentures 95, 4 p.ct. consolidated debenture 76, South Metropolitan 105½, 105¾, 6 p.ct. preference 111, 3 p.ct. debenture 60, South Suburban 5 p.ct. debenture 98. Supplementary prices, Derby 5 p.ct. 110½, Newport (Mon.) 5 p.ct. 76, 76½, Wandsworth 5 p.ct. debenture 100, 100½.

On Wednesday, Bournemouth 7 p.ct. £12 5s. 9d., £12 7s., Brighton and Hove 5 p.ct. 105½, British 115, 115½, Commercial 99½, 99¾, 3 p.ct. debenture 60, Continental Union 32, 7 p.ct. preference 94, European 8, Gas Light and Coke 18s. 7¼d., 18s. 9d., 18s. 10½d., 19s., 4 p.ct. preference 78½, 3 p.ct. debenture 61½, 61¾, Brentford debenture 103½, Imperial Continental 164, 168, 169, Malta and Mediterranean 5½, North Middlesex 6 p.ct. 99½, Primitiva 27s. 6d., 27s. 7¼d., 27s. 10¼d., 28s., 4 p.ct. consolidated debenture 76⅞, South Metropolitan 105, 105¼, 105½, 105¾, 105⅞, Tottenham "B" 95, Wandsworth "B" 112, 3 p.ct. debenture 58. Supplementary prices, Grays and Tilbury new 5 p.ct. debenture 96, Reading 5 p.ct. maximum 82½, 83, Southend-on-Sea 4 p.ct. debenture 75, Wandsworth 5 p.ct. debenture 100½.

On Thursday, Aldershot 4 p.ct. preference 71½, Bournemouth 6 p.ct. preference 11, 11⅛, British 4 p.ct. debenture 74, Cape Town 4½ p.ct. preference 6¾, 6¹⁵⁄₁₆, 4½ p.ct. debenture 75, Commercial 99½, Continental Union 32, 33½, Gas Light and Coke 18s. 8¼d., 18s. 9d., 18s. 9¾d., 18s. 10½d., 19s., 4 p.ct. preference 78½, 79½, Imperial Continental 165, 166, 168, 170, Maidstone 5 p.ct. 110, 112, Malta and Mediterranean 5½, Newcastle 3½ p.ct. debenture 67⅞, Primitiva 27s. 3d., 27s. 4½d., 27s. 7¼d., 27s. 9d., 27s. 10¼d., 4 p.ct. consolidated debenture 76, 76½, 4 p.ct. debenture (1911) 77, 77½, South Metropolitan 105¼, 105½, 105¾, 106⅛, 3 p.ct. debenture 60, 6½ p.ct. debenture 100⅛, South Suburban 5 p.ct. 106¼, 5 p.ct. debenture 96½, 98, Swansea 7 p.ct. preference 101, 101½, Wandsworth, Wimbledon 5 p.ct. 109, 109½, 110. Supplementary prices, Newport (Mon.) 5 p.ct. maximum 79, Redhill 5½ p.ct. preference "A" 98½, Wandsworth 5 p.ct. debenture 100½.

On Friday, Alliance and Dublin 95⅝, British 4 p.ct. debenture 76, Commercial 99¼, Continental Union 32, 33½, 34, 34⅛, Croydon sliding-scale 107½, maximum dividend 82, 83, European 8½, Gas Light and Coke 18s. 9d., 18s. 9¾d., 18s. 10½d., 19s., 4 p.ct. preference 78½, 78⅝, 79½, Imperial Continental 167, 167⅜, 169, Maidstone 5 p.ct. 115, Newcastle 3½ p.ct. debenture 67, Oriental 116, Primitiva 26s. 9d., 27s., 27s. 3d., 27s. 6d., San Paulo 6 p.ct. preference 8¼, South Metropolitan 105½, 3 p.ct. debenture 60, 6½ p.ct. debenture 101½, South Suburban 5 p.ct. 106, 107, Southampton 5 p.ct. maximum 79, Swansea 7 p.ct. preference 102, Wandsworth 3 p.ct. debenture 59½. Supplementary prices, Croydon 6 p.ct. debenture 101.

In Lombard Street money for the day was in plentiful supply, and the rate for renewals was reduced to 3½ p.ct., while fresh credits were obtainable down to 2⅛ p.ct. Treasury Bills were allotted at an average of £3 18s. 2·37d. p.ct., or just over 3d. p.ct. below the previous week's rate. Discount rates were therefore undisturbed.

On the Foreign Exchange Market, Sterling on New York was firm, and American buying raised the rate to 4.88 3/32. French francs were firm at 124, Belgas at 34.94½, and Dutch florins at 12.09⅛ moved slightly against London. Liras improved to 92.62½, and pesetas at the close stood at 29.33½.

Silver was higher at 26 11/16d. per oz. on Chinese buying; and with no Gold movements the price remained at 84s. 11d. per oz.

The Bank Rate is 4½ p.ct., to which it was reduced from 5 p.ct. on April 21, 1927. The Banks' deposit rate is 2½ p.ct.

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. May 4.	Rise or Fall on Week.	Transaction Lowest and Highest Prices.
£			% p.a	% p.a.				
171,978	Stk.	Feb. 9	8	8	Aldershot 5 p.c. max. C.	70—75	..	..
412,992	"	Apl. 12	4	4	Do. 4 p.c. Pref.	69—72	..	..
1,651,868	"	Jan. 12	7	7	Alliance & Dublin Ord.	93—96	..	71⅞
674,000	"	Mar. 8	4	4	Do. 4 p.c. Deb.	64—67	..	95⅝
592,654	"	Apl. 26	7	7	Barnet Ord. 7 p.c.	109—112	..	..
300,000	1	Mar. 8	1/7½	1/7½	Bombay, Ltd.	21/—23/•	..	..
170,000	10	"	8½	8½	Bournemouth 5 p.c.	12⅝—13¼	..	..
500,050	10	"	7	7	Do. B 7 p.c.	12—12⅝	..	..
375,000	10	"	6	6	Do. Pref. 6 p.c.	10½—11	..	12/6/9—12/7/-
50,000	Stk.	Jan. 12	3	3	Do. 3 p.c. Deb.	56—59	..	11—11⅛
123,025	"	"	4	4	Do. 4 p.c. Deb.	76—79	..	..
857,900	"	Mar. 8	7½	7½	Brighton & Hove 6 p.c. Con.	115—118	..	..
341,980	"	"	4/8/62	6⅔	Do. 5 p.c. Con.	103—106	..	..
1,287,500	"	Feb. 23	5	5	Bristol 5 p.c. max.	87—88a	..	105½—106
885,000	"	Mar. 22	8	8	British Ord.	113—116	..	..
180,000	"	Dec. 22	7	7	Do. 7 p.c. Pref.	114—117	..	115—115½
120,000	"	"	4	4	Do. 4 p.c. Red. Deb.	73—76	..	..
200,000	"	"	—	88/2	Do. 5 p.c. Red. Deb.	93—96	+1	74—76
100,000	"	Nov. 24	8	6	Cape Town, Ltd.	8—9	..	..
100,000	10	Apl. 26	4½	6	Do. 4½ p.c. Pref.	6¾—7¼•	..	..
100,000	Stk.	Dec. 22	4½	4½	Do. 4½ p.c. Deb.	72—77	..	6⅞—6¹³⁄₁₆
636,860	"	Feb. 23	6	6	Cardiff Con. Ord.	98—101	..	75
187,860	"	Jan. 12	7½	7½	Do. 7½ p.c. Red. Deb.	101—104	..	..
187,150	"	Feb. 23	5	6⅔	Chester 5 p.c. Ord.	87—92b	..	..
79,185	1	Apl. 26	12/-	1/4½	Colombo Ltd. Ord.	81/—83/•	..	..
24,495	1	"	1/3½	1/4½	Do. 7 p.c. Pref.	20/—22/•	..	..
375,402	1	Apl. 12	1/3½	1/3½	Colonial Gas Assn. Ld. Ord.	23/—25/-	..	..
187,848	1	"	1/7½	1/7½	Do. 5 p.c. Pref.	20/—22/-	..	..
3,073,280	Stk.	Feb. 23	5	7	Commercial Ord.	98—101	..	..
475,000	"	Dec. 22	3	3	Do 8 p.c. Deb.	58—61	..	99½—99⅝
300,000	"	Sept. 29	11	11	Continental Union, Ltd.	30—35	..	10
787,560	"	Mar. 8	7	7	Do. 7 p.c. Pref.	84—93	+1	32—34½
103,100	"	Mar. 8	6½	7	Croydon sliding scale	105—108	..	93—94
492,270	"	"	5	6	Do. max. div.	81—84	..	107½
65,000	"	Mar. 8	7	10	Derby Con.	110—115e	..	82—83
339,000	"	Dec. 22	4	4	Do. Deb.	71—73e	..	..
50,000	"	Mar. 8	5	5	East Hull Ord. 5 p.c.	76—79	..	..
1,002,180	"	Dec. 22	5	5	Eastbourne 5 p.c. Deb.	90—95	..	..
15,703,480	10	Mar. 22	14	16	European, Ltd.	8 9	..	..
3,600,000	Stk.	Feb. 9	5	5/1/4	Gas Light & Coke 4 p.c. Ord.	18/9—19/8/	+·/3	8—8¼
4,187,630	"	"	3½	3½	Do. 3½ p.c. max.	63—65	..	18/7½—19/-
5,892,620	"	Dec. 22	3	4	Do. 4 p.c. Con. Pref.	77—80	..	..
181,315	"	"	6	8	Do. 3 p.c. Con. Deb.	60—62	..	78¼—79¼
1,642,770	"	"	5	6	Do. 6 p.c. Br'tf'd Rd. Db.	102 105	..	61⅛—61⅜
49,000	"	—	7½	5	Do. 5 p.c. Red. Deb.	99—101	..	103½
88,600	"	Mar. 8	6⅔	7½	Do. 7½ p.c. Ilford Deb.	..	..	..
458,710	"	"	5½	6⅔	Hastings & St L. 5 p.c. Conv	87—90	..	..
70,000	10	Apl. 26	10	5½	Do. 3½ p.c. Conv.	68—71	..	..
178,200	Stk.	Mar. 8	5	110	Hongkong & China, Ltd.	13½—14¼•	..	..
4,976,000	"	Nov. 10	10	5	Hornsey Con. 8½ p.c.	78—81	..	..
233,130	"	Feb. 9	8½	10	Imperial Continental Gas.	167—172	..	..
305,942	"	Mar. 8	7	8½	Do. 8½ p.c. Red. Deb.	68—70	+7	162 170
2,145,907	"	Feb. 23	5½	7	Lea Bridge 5 p.c. Ord.	94—97	..	..
600,000	"	Mar 22	7	5½	Liverpool 5 p.c. Ord.	88—89b	..	..
185,736	"	Feb. 23	9	7	Do. 7 p.c. Red. Pref.	101⅛—103½‡	..	..
16,000	5	Dec. 22	17	8	Maidstone 5 p.c. Cap.	109—112	..	..
641,990	Stk.	Nov. 24	17	18	Malta & Mediterranean	5¼—6	+1	110—115
1,001,815	"	Mar. 8	5	15	Montevideo, Ltd.	92½—94½	..	5⅝—5¾
800,929	"	"	4	5	Newcastle & Gateshead Con.	16/3—17/3d/	..	..
691,705	"	June 29	8½	4	Do. 4 p.c. Pref.	66¼—67½d	..	..
131,780	"	Mar. 8	6/18/0	8½	Do. 3½ p.c. Deb.	66¼—67½d	..	..
900,000	"	Apl. 26	9	6/18/0	North Middlesex 6 p.c. Con.	97—100	..	..
188,130	"	Dec. 22	7½	7	Oriental, Ltd.	113—118•	..	99½—99⅝
414,600	"	Feb. 23	7½	7½	Plym'th & Ston'house 5 p.c.	102—107	..	116
296,783	"	"	5	7½	Portsm'th Con. Stk. 4p.c. Std.	101—104	..	..
2,334,484	1	—	—	5	Do. 5 p.c. max.	77— 80	..	..
344,500	100	Dec. 1	4	4	Primitiva Ord.	27/—28/-	..	..
945,000	Stk.	Jan. 26	4	4	Do. 4 p.c. Red. Deb.	92—96	—/6	26/9—28/3
416,345	"	Dec. 22	4	4	Do. 4 p.c. Red. Deb. 1911	76—78	+1	95
150,000	10	Mar. 22	4	4	Do. 4 p.c. Cons. Deb.	75—77	..	77—77½
235,000	50	Jan. 8	6	6	San Paulo 6 p.c. Pref.	8—8½	..	76—76½
970,000	Stk.	Mar. 22	6	6	Do. 5 p.c. Red. Deb.	46—48	..	8½
419,968	"	"	6	6	Sheffield A	100—102e	..	..
1,047,000	"	"	6	6	Do. B	100—102e	..	..
90,000	"	"	6	6	Do. C	100—102e	..	..
2,688,695	10	May 26	4	6	South African	4—6	..	..
600,000	Stk.	Feb. 23	5	7½	South Met. Ord.	104—106	..	..
1,895,445	"	"	—	6	Do. 6 p.c. Irred. Pf.	109—112	..	105—106½
734,000	"	Jan. 12	3	8	Do. 3 p.c. Deb.	59—62	..	111
61,500	"	Mar. 8	6½	8½	Do. 5½ p.c. Red. Db.	100—102	..	60
1,343,795	"	Feb. 23	8½	8½	South Shields Con.	112—114d	..	100⅛—101½
886,877	"	Feb. 23	6½	6½	South Suburban Ord. 5 p.c.	105—108	..	..
847,740	"	Dec. 22	5	5	Do. 5 p.c. Deb.	96—98	..	106—107
121,976	"	Mar. 22	5	5	South'mpton Ord. 5 p.c. max	78—80	..	96¾—98
380,000	"	Dec. 22	4	4	Do. 4 p.c. Deb.	72—75	..	79
200,000	"	Mar. 8	7	7	Swansea 7 p.c. Red. Pref.	100—103	..	..
130,000	"	Dec. 22	6½	6½	Do. 6½ p.c. Red. Deb.	99—102	..	101—102
699,276	"	Feb. 23	7½	7½	Tottenham District A 5 p.c.	115—120	..	..
150,000	"	"	6½	6½	Do. B 5½ p.c.	99—98	+3	..
181,355	"	"	5½	5½	Do. 5½ p.c. Pref.	98—101	..	95
	"	Dec. 8	4	4	Do. 4 p.c. Deb.	74—77	..	..
269,994					Uxbridge, Maidenhead, &			
68,250	"	Mar. 8	5½	6⅔	Wycombe 5 p.c.	90—95	..	..
	"	"	5	5	Do. 5 p.c. pref.	86—90	..	..
50,000					Wandsworth, Wimbledon,			
355,686	"	Mar. 8	8½	8½	and Epsom—			
491,595	"	"	7	7	Wandsworth A 5 p.c.	129—134	..	..
258,000	"	"	5/19/0	5/19/0	Do. B 5½ p.c.	111—116	..	..
98,000	"	"	6⅔	6⅔	Do. C and New	98—103	..	112
100,000	"	"	7½	7½	Do. Wimbledon 5 p.c.	106—111	..	..
88,416	"	"	5	5	Do. Epsom 5 p.c.	112 —117	..	109—110
54,740	Dec. 22		8	8	Do. 5 p.c. Pref	86—91	..	..
	"		4	4	Do. 3 p.c. Deb.	57—60	..	..
					Do. 4 p.c. Deb.	76—79	..	58—59½

Quotations at:—a.—Bristol. b.—Liverpool. c.—Nottingham. d.—Newcastle. e.—Sheffield. f.—The quotation is per £1 of Stock. • Ex. div. † Paid free of income-tax. ‡ For year.

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(Gas Department.)

THE Magistrates and Council invite Applications for the Position of SUPERINTENDENT at Granton Works.
The party appointed should be not over 45 years of Age, and must be a fully qualified Engineer, with experience of Vertical and Inclined Retorts, Water Gas, and Recovery of Bye-Products.
He must have occupied a similar position in a large Works and also be a Member or Associate Member of The Institution of Gas Engineers and hold the Diploma of that Institution or the Technological Certificate of the City and Guilds of London Institute.
The commencing salary will be at the rate of £500 per Annum, with free Residence, Fuel, and Light, at the Works.
Applications, stating Age and full Particulars of Training and Experience, present Salary, and *copies* of not more than Three recent Testimonials, to be addressed to the undersigned to arrive not later than the 31st of May, 1928, endorsed "Superintendent."

H. H. Gracie,
Engineer and Manager.

15, Calton Hill,
Edinburgh,
May 8, 1928.

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(Gas and Water Departments.)

APPLICATIONS are invited from fully-qualified Persons for the Position of GAS and WATER ENGINEER and MANAGER to the Corporation of Kendal, at a commencing Salary of £360 per Annum (*plus* House, Rent, and Rates free), such salary to be increased to £400 per Annum in four years by annual increments of £10.
Applicants to state Age, whether Married or Single, past Experience, Qualifications, and the earliest date when they can commence Duties. Previous experience in the Woodall-Duckham System of Vertical Retorts is essential.
The person appointed will require to devote the whole of his time to the duties of the office, and will not be allowed to engage in private practice.
The appointment will be terminable by Three Calendar Months' Notice on either side.
Applications, together with *copies* of Three recent Testimonials, to be delivered to the Town Clerk, 14, Kent Street, Kendal, endorsed "Gas and Water Engineer," not later than the first post on Wednesday, the 23rd day of May, 1928.
Canvassing, directly or indirectly, will be a disqualification.

J. E. Bolton,
Town Clerk.

14, Kent Street,
Kendal,
May 7, 1928.

APPLICATIONS are invited for the Post of SENIOR GAS-WORKS CHEMIST, to Take Charge of the Laboratory and Supervise the Tests of the Staff at the Hendon Works of the Sunderland Gas Company. It is essential that Applicants should have had practical experience in Gas or Bye-Products Works.
Applications, in own Handwriting, stating Age, Experience, Qualifications, and Salary required, with *copies* of not more than Two recent Testimonials, should be sent to The Engineer, Hendon Gas-Works, Sunderland, by May 15, 1928.

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Apply (in confidence), stating Age, Experience, and Salary required, to No. 7855, "Gas Journal," 11, Bolt Court, Fleet Street, E.C. 4.

JUNIOR Clerk (21 to 25) required in the London Office of a Public Company. Must be competent and have had Experience with Accountancy, Registration Work, &c. Commencing Salary, £160 per Annum.
Applications (in own handwriting), accompanied by *copies* of Three Testimonials, furnishing full particulars of Education, previous Experience, &c., to be addressed to "P.L.," care of Streets, 6, Gracechurch Street, E.C. 3.

CONTRACTS OPEN.

BOROUGH OF PONTEFRACT.
(Gas Department.)

TENDERS are invited for the Renewal of Two Beds of Eight RETORTS.
Sealed Tenders, endorsed "Retorts," should be sent to the undersigned not later than Twelve noon on May 21, 1928.
Further particulars can be obtained from Mr. B. Hudson, Gas Engineer's Office, Pontefract.

F. M. Farmer,
Town Clerk.

Municipal Offices,
Pontefract.